

Do consumers perceive benefits from the implementation of a EU mandatory nutritional labelling program?

Azucena Gracia ^{a,*}, Maria Loureiro ^{b,1}, Rodolfo M. Nayga Jr. ^{c,2}

^a *Unidad de Economía Agraria, Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA),
Avda Montañana 930, 50059 Zaragoza, Spain*

^b *IDEGA-Universidade de Santiago de Compostela, Avda. das Ciencias, s/n,
15782 Santiago de Compostela, Spain*

^c *Department of Agricultural Economics, Texas A&M University, College Station,
TX 77843-2124, USA*

Received 4 April 2005; received in revised form 3 April 2006; accepted 4 April 2006

Abstract

This paper examines consumers' knowledge about nutritional labels (i.e., nutritional panel), use of nutritional labels, and perceived benefits from a mandatory nutritional labeling program. Using data from a pilot study conducted in a Spanish city and a three-equation multivariate probit model, our results suggest that individuals who suffer some health problems related to food intake are more knowledgeable about nutritional labels. Further, those who are more knowledgeable about nutritional labels are more likely to use nutritional labels, and nutritional label users are more likely to consider mandatory nutritional labeling as beneficial. Perceived usefulness of the information provided by nutritional labels as well as the amount of presented information affect consumer perceptions about whether or not mandatory nutritional labeling would be beneficial.

© 2006 Elsevier Ltd. All rights reserved.

* Corresponding author. Tel.: +34 976 716350; fax: +34 976 716335.

E-mail addresses: agracia@aragon.es (A. Gracia), maria.loureiro@usc.es (M. Loureiro), rnayga@tamu.edu (R.M. Nayga Jr.).

¹ Tel.: +34 981563100x14337; fax: +34 981599935.

² Tel.: +1 979 845 8376; fax: +1 979 862 3019.

Keywords: Diet; Health; EU nutritional labeling; Consumers; Spain

Introduction

It is well documented that good nutrition and diet can contribute to the prevention of some illnesses (cardiovascular, some cancers, diabetes, etc.) and premature death (Bush and Williams, 1999). In fact, in Europe, cardiovascular disease is one of the main causes of death, accounting for 49% of all deaths (European Heart Network, 2002). To prevent and mitigate the prevalence of such illnesses, policies that have an impact on the type of food produced (i.e., food composition standards, school and workplace nutrition standards) and/or may influence the types and quantities of foods consumed by Europeans (i.e., nutrition labeling legislation, nutrition education) may be helpful and pertinent (European Heart Network, 2002).

Consequently, the EU authorities introduced several proposals related to nutrition in the White Paper on Food Safety. In particular, the White Paper referred to the development of recommendations for dietary guidelines, establishment of appropriate information tools and promotion of nutrition research. More specifically, the White Paper on Food Safety announced the intention of the Commission to put forward a proposal amending Council Directive 90/496/EEC on nutrition labeling for foods in order to bring the provisions on nutrition labeling in line with consumer needs and expectations (Action No. 66). The White Paper indeed identified nutrition labeling as an important tool in helping consumers make informed dietary choices, adapted to their individual needs. Under the current Directive 90/496/EEC, nutrition labeling is optional but it becomes compulsory when a nutrition claim is made in the labelling or advertising of a foodstuff. The Directive also lays down a standardised format in which nutrition labeling must be presented. Two types of declarations are provided for: (i) Group 1, basic information to be given when nutrition labeling is provided consisting of energy, protein, carbohydrate and fat; and (ii) Group 2, extended information required if a declaration is made for certain nutrients consisting of energy, protein, carbohydrate, fat, saturates (fatty acids without double bond), sugars, sodium/salt and fiber. Information may also include the amounts of a number of other nutrients such as starch, polyols (sugar-free sweeteners), non- and poly-unsaturates, cholesterol and vitamins and minerals listed in the Annex of the Directive. Technical details including, among others, the energy conversion factors for certain nutrients and the units to be used for the declaration of the nutrients are also provided in the Directive.

Following this review of existing legislation, the European Commission is preparing a proposal to amend the current Nutrition Labeling Directive. The overall objective is to improve the existing nutrition labeling rules in order to further facilitate consumer understanding and informed choices, and aid consumers in selecting healthy diets, appropriate for their individual needs. To date, the Commission has identified 10 topical areas to be taken into account in the future revision of the Directive: (i) nature of declaration: voluntary versus mandatory; (ii) nutritional information to be provided; (iii) presentation of nutrition information; (iv) link with recommendations regarding healthy diets; (v) reference quantity for nutritional declaration; (vi) specific measures for non-prepackaged foodstuffs; (vii) energy conversion factors; (viii) declaration of vitamin and mineral content;

(ix) tolerances for declaration of nutritional values and; (x) definitions. To shed some light on these issues, the Commission launched in 2003 a consultation among Member States and stakeholders on the possible impacts associated with the future revision of the Nutrition Labeling Directive.³

In this current paper, we will focus on analysing the first of the mentioned issues, related to whether nutrition labeling should still be voluntary or if on the contrary, it should be mandatory in all Member States. The previous consultation indicated that some Member States are in favor of the mandatory implementation (e.g., Denmark, UK) while others support the continuation of the voluntary system (e.g., Ireland). Consumer organizations and different professional associations (e.g., Associations of dietitians, International Obesity Taskforce, European Heart Network) are in favor of mandatory nutritional labelling, with some exemptions. Finally, the agri-food and retail sectors recognize the importance of providing nutritional information to consumers. However, they pointed out that the decision of whether to make nutrition labeling mandatory or not needs to be assessed within the context of the broader discussion of nutrition policy.

In addition to this previous consultation, the Directorate General for Health and Consumer Affairs, (from now on DG SANCO) of the European Commission conducted a study to analyse the potential impact of the introduction of mandatory nutrition labeling for pre-packed food products across the EU (DGSanco, 2004). In particular, two main aspects have been analyzed: (i) the potential impact of nutrition labeling on consumer health and; (ii) the cost of nutrition labeling to the European food industry. Main conclusions drawn from the DG SANCO study regarding the first posed question neither provided the answers to dilemmas on policy options, nor ultimately answered the question posed referring to the benefits of nutrient labeling to consumers. It also mentioned that further work was required to better understand the reason for non-use of nutritional information and the interventions required to stimulate both consumer interests on food choice and their use of labeling. The estimation of the costs associated with mandatory nutritional labelling showed that it would be very significant for most companies, bearing in mind that in excess of two thirds of the companies would have to introduce it on at least some of their products. The total costs of mandatory labeling were estimated in excess of €560 millions across European food companies.⁴

The final decision of mandatory labeling approval will be based on the expected effectiveness and/or benefit of the regulation. In the US, some studies have analysed the effectiveness and/or benefits of the implementation of mandatory nutrition labeling regulation. *Mojduszka and Caswell (2000)* studied the effectiveness of markets in providing information to consumers on the nutrition quality of processed food prior to the implementation of a mandatory labeling scheme. Results showed that markets were not effective in providing information to consumers on the nutritional quality of food products. The authors then concluded that requirements for mandatory nutritional labelling were necessary to increase the amount of nutritional information available to consumers. The previous

³ The comments provided by EU Member States, EFTA countries, consumers groups, health NGO's, Food and Drink industry, Retailers and Catering industry on the proposal amending Council Directive 90/496/EEC are available in the web page http://europa.eu.int/comm/food/food/labellingnutrition/nutritionlabel/comments_en.htm.

⁴ The survey consisted of 203 food companies in 21 European countries. Consequently, we caution about the difficulty of extrapolating this figure across the EU food industry.

voluntary system did not generally result in reliable and consistent nutritional information. Caswell et al. (2003) looked at the number of nutrient-claims made before and after passing the mandatory implementation of nutritional labeling, concluding that the number of claims had declined slightly, while there was a redistribution of claim activity among food categories. Crutchfield et al. (2001) calculated the potential benefits for a new regulation requiring nutritional information for raw meat and poultry products by estimating the benefits of preventing premature death. They estimated that the annual benefit of the new nutritional labeling regulation will lie between \$61.8 million and \$125 million and they state that benefits are greater than the costs. Finally, Teisl et al. (2003) measured the welfare impacts of providing nutrient information (although not linked to a mandatory program) using a value of information approach. They calculated that the value of the benefit of nutritional labeling for different products is higher than those calculated with commonly used cost of avoided illness approach.

In the EU, due to the expected costs of implementing the mandatory nutritional labeling, no consensus among Member States and stakeholders has been reached on the need for a mandatory implementation of nutrition labeling. Consequently, it would be very helpful for policy makers to know whether consumers perceive any benefits on the implementation of a mandatory nutritional labeling program. Thus, the goal of this paper is to analyse whether consumers consider the provision of mandatory nutritional labeling to be beneficial. Specifically, this paper investigates the factors influencing consumers' perceived benefits linked to the implementation of mandatory nutritional labelling defined in the EU regulation. In addition, it also examines consumers' use and knowledge of nutritional labeling in the EU.

To achieve these goals, instead of independently analysing consumers' use, knowledge and benefits of nutritional labeling, we have simultaneously modeled all three variables. We have first analysed the level of knowledge on nutritional labels and the main factors explaining this knowledge. Then secondly, we have investigated nutritional label use taking into account the knowledge about nutritional labels as an explanatory factor. Finally, we have assessed consumer' perceived benefit of mandatory nutritional labeling, considering that label use influences the probability of considering mandatory nutritional labeling as beneficial. Due to the discrete and ordinal nature of the dependent variables, we have specified and estimated a multivariate limited dependent variable model. In this application, data came from a survey of 400 food shoppers conducted during the spring of 2004 in a city of Spain.

This paper is structured as follows. Section 'Model specification' contains the description of the model and discusses the previous literature; Section 'Data and the definition of variables' describes the data, the descriptive information about participants' characteristics and defines the expected relationships among variables. Section 'Results' contains the empirical results, and lastly Section 'Concluding remarks' concludes with some remarks and policy implications.

Model specification

The question of whether consumers perceive any benefits from the implementation of a mandatory nutritional labeling program for pre-packaged food is difficult to answer because this depends on many factors, which vary across individuals. However, consumers' perceived benefits linked to the mandatory provision of nutrition information will

depend on the level of risk associated with the food product intake. This implies that if an individual has some health problems related to the intake of some specific nutrients, i.e., salt, he/she will show a higher propensity to consider the provision of mandatory nutrition labeling as beneficial. In addition, consumers' propensity to use nutritional information (label usage) will influence consumers' perceived benefits linked to the mandatory nutrition labelling. This occurs because the label reduces consumers' uncertainty about the food product and/or transforms credence attributes of food products into search attributes (Mojduszka and Caswell, 2000). Therefore, it is expected to find a positive relationship between consumers' probability to consider mandatory nutrition labeling beneficial and consumers' probability to use nutrition labels. Similarly, consumers' attitudes towards nutritional labeling would have an influence on the probability that the consumer will consider mandatory nutrition labeling beneficial. Consequently, both variables, nutrition label usage and consumers' attitudes towards nutrition labeling will explain consumers' perceived benefits linked to the implementation of mandatory nutrition labeling. Finally, perceived benefits may vary greatly across individuals, depending on their economic and socio-demographic characteristics.

Consequently, consumers' perceived benefits linked to the provision of mandatory nutrition labeling is specified as follows:

$$B_i^* = \lambda LU_i^* + \beta X_i + u_i \quad (1)$$

where, LU_i^* is the variable related to consumers label use defined below, X_i is a vector of exogenous variables, and u_i is the error term normally distributed $N(0, \sigma_u^2)$. B_i^* is the unobserved utility. Note that the part observed by the researcher is whether the individual states perceiving mandatory nutrition labeling as beneficial ($B_i = 1$) or not ($B_i = 0$), and both variables, observed and latent are related as follows:

$$\begin{aligned} B_i &= 1 & \text{if } B_i^* > 0 \\ B_i &= 0 & \text{if } B_i^* \leq 0 \end{aligned} \quad (2)$$

Nutrition label use has been broadly analysed in the literature, mainly in US. Some of these contributions are those by Guthrie et al. (1995), Wang et al. (1995), Piedra et al. (1996), Nayga (1996, 1997), Shine et al. (1997a,b), Szykman et al. (1997), Nayga et al. (1998), Nayga (2000), Kim et al. (2001), McLean-Meynsse (2001), and Drichoutis et al. (2005). These previous studies have found that factors determining nutritional label use are mainly: (i) socio-demographic characteristics; (ii) economic conditions; (iii) time pressure; (iv) health awareness; (v) health status; (vi) source of nutritional information; and (vii) consumers' perception of the importance of different food attributes, among others.

However, some of the mentioned studies argued that nutritional knowledge is also an important factor explaining nutritional label use as noted by Guthrie et al. (1995), Nayga (2000), Kim et al. (2001), and Drichoutis et al. (2005). This set of studies use the economic model of information search as baseline to model nutrition label use. This framework assumes that the utilization of product information, such as nutrition labeling, is an active process that involves searching out information, evaluating its meaning, and making a decision based on that evaluation. The economics of information predicts that the consumer will continue to acquire and process information as long as the cost of additional acquisition and processing do not outweigh the additional benefits. Nutrition knowledge was considered, except in Guthrie et al. (1995), as an endogenous variable in

the nutritional label use equation. All of these mentioned studies analysed American consumers except the study of Drichoutis et al. (2005), which employed a sample of Greek consumers.

However, some of their findings are contradictory. For example, while Nayga (2000) found that nutrition knowledge does not have influence over label use, Guthrie et al. (1995), Kim et al. (2001) and Drichoutis et al. (2005) indicate that consumers with more health knowledge are more likely to use nutritional labels when shopping for food. These differences in results could be due to differences in methodologies, samples, timing, etc.

The Label Use equation is defined as follows:

$$LU_i^* = \delta K_i^* + \alpha Z_i + e_i \quad (3)$$

where K_i^* is the consumer's nutritional knowledge defined below; Z_i contains all exogenous variables and e_i is the error term normally distributed $N(0, \sigma_{e^2})$. LU_i^* is unobserved, and as before, the researchers observe the response of whether the individual uses nutritional labels when shopping ($LU_i = 1$) or not ($LU_i = 0$), and both, observed and latent variables are related as follows:

$$\begin{aligned} LU_i &= 1 & \text{if } LU_i^* > 0 \\ LU_i &= 0 & \text{if } LU_i^* \leq 0 \end{aligned} \quad (4)$$

Finally, the level of knowledge about nutritional labels is defined as:

$$K_i^* = \varpi Y_i + \xi_i \quad (5)$$

where, Y_i represents the exogenous variables and ξ_i is the error term normally distributed $N(0, \sigma_{\xi}^2)$. K_i^* is unobserved, what is observed is the ranking of knowledge given by the individual in the survey:

$$\begin{aligned} K_i &= 1 & \text{if } K_i^* \leq \mu_1 (= 0) \\ K_i &= 2 & \text{if } \mu_1 < K_i^* \leq \mu_2 \\ K_i &= 3 & \text{if } \mu_2 < K_i^* \leq \mu_3 \\ &\dots\dots\dots \\ K_i &= J & \text{if } \mu_{j-1} \leq K_i^* \end{aligned} \quad (6)$$

where the μ_i are the unknown threshold parameters to be estimated with ϖ . The first threshold parameter is typically normalized to zero ($\mu_1 = 0$) in order to estimate one less parameter.

Fig. 1 provides a graphic illustration of the three equations and the theoretical model consisting of the relationship between endogenous variables, while containing the major groups of independent variables that may affect each of the equations.

Instead of independently estimating Eqs. (1), (3) and (5), and given that some endogenous variables are also exogenous in other equations, we consider that they form a multivariate limited dependent variable model where the three error terms (u_i , e_i and ξ_i) follow a multivariate normal distribution with mean zero and variance and covariance matrix Ω . The classical estimation of limited dependent variable (LDV) models with correlated error terms is computationally demanding due to a need for high dimensional numerical integration (Hajivassiliou and McFadden, 1998). Therefore, the estimation is done using Monte Carlo integration following the Hajivassiliou and McFadden's procedure.

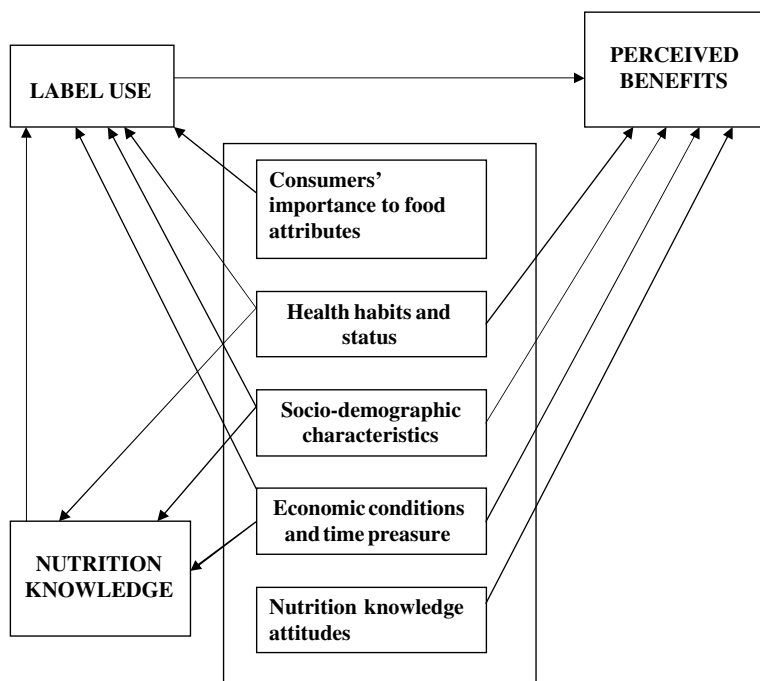


Fig. 1. Empirical model.

Data and the definition of variables

Survey design and characteristics

This study uses survey data gathered from 400 food shoppers during the Spring of 2004 in Zaragoza, Spain. Zaragoza is a town widely used by food marketers and consulting companies since the socio-demographics of this town are representative of the Spanish Census of Population (see [Appendix, Table A](#)). The final sample was selected using a stratified random sample selection of consumers on the basis of town district and age. Food shoppers were randomly selected outside food outlets and supermarkets. The interviewers proceeded with the survey when the approached individual stated being the main household food shopper of the household.

The questionnaire was pre-tested in a small sample of individuals (25) with the aim of assessing the clarity of the questions presented, and the overall consumers' understanding of the survey format. The survey included a wide variety of questions including shopping habits, food preferences; and other attitudinal variables; including whether the individual read the nutritional labels provided by food manufacturers; the degree of knowledge on nutritional content of labels, and whether they considered that the mandatory implementation of nutritional labeling would benefit them. Before participants were asked about the benefits of nutritional labeling, respondents were informed about the fact that the European Commission is contemplating to enact a new mandatory nutritional labeling law in the European Union. This law, if approved, will require that all food products, except

fresh products (i.e., fresh meats, fruits and vegetables) include nutritional content information (fats, fiber, etc). Finally, other questions related to healthy habits, lifestyles, individual's weight, and socio-demographics were also asked.

In this sample, the majority of respondents were female (71.8%). The respondents' average age was about 47 years, and they primarily lived in households of three members. The mean household income of the sample was calculated to be between €1500 and €2000 per month for the 2004 calendar year, and their average education included a high school degree. Summary statistics and variable descriptions are presented in Table 1. Our sample is comparable to the current Spanish Census of Population in terms of education, number of children per household and household size. However, this sample includes fewer minorities, which is a feature common to many other surveys and empirical studies.

Regarding their health habits, 54.25% of respondents stated that they practice some sport or exercise regularly. Concerning their health status, about 32.5% of individuals in the sample reported having health problems related to food intake, and other 22% of consumers stated that they or a member of their household must follow a special diet with medical prescription.

Finally, consumers were asked to rate the importance of different attributes when shopping; such as price, expiration date, and the presence of a nutritional label using a Likert scale from 1 to 10, where 10 meant maximum importance (Table 1). Survey participants pay more attention to the expiration date and the price, and lower importance to the presence of nutritional labels. In addition, consumers were asked to what extent they think that information provided in an example of a nutritional label is informative and useful (which we denote as informative), or if it is too detailed, confusing or there is too much information (denoted as confusing). They rated both statements in a scale from one to 10 according to the degree of agreement. The average rating of "informative" is higher (7.0) than the average rating of "confusing" (3.1).

Definition and expected relationship of variables

The endogenous variables of interest are discrete choice variables. The perceived benefits of implementing a mandatory nutrition labeling is a binary (0,1) variable where 1 means that consumers believe that the mandatory implementation of a nutrition label is beneficial and 0 otherwise (BENEFICIAL) (Table 1). Nutrition labeling use is also a binary variable where 1 means that the consumer always or very often reads nutritional labels when shopping, and 0 otherwise (LABELUSE). Finally, nutrition knowledge is an ordinal variable with 5 categories, which rate the degree of knowledge on nutritional labeling from 1 (low) to 5 (high) (KNOWLEDGE).

Following the previous studies mentioned in Section 'Model specification', the socio-demographic variables included in the model are gender, age, and education (the definition of variables is available in Table 1). We expect that females are more knowledgeable on nutrition labels showing a higher propensity to use them. Similarly, older consumers are more likely to have health problems, being therefore more concerned regarding the healthiness of the food they eat. Thus, they are expected to be more likely to use nutritional labels and to have a higher knowledge about nutritional labels. Education is included in the nutrition knowledge equation because more educated consumers may be more likely to read about and to be exposed to health/nutrition information, so that they may carry a higher knowledge. However, it is excluded from the label use equation

Table 1
Socio-demographic characteristics of the sample

	Variable name in the model	
<i>Socio-demographic characteristics</i>		
Gender		
Male	FEMALE	28.2%
Female		71.8%
Age (average from total sample)	AGE	46.8 (17.5)
Education of respondent	EDUCATION	
Without education		7%
Elementary school		28%
High school		41%
University		24%
<i>Economic conditions and time pressure</i>		
Average household income	INCOME	
Below 900 €		18.1%
Between 900 and 1500€		18.5%
Between 1500 and 2100€		33.0%
Between 2100 and 3000€		24.1%
More than 3000€		6.3%
Household size (average from total sample)	HHSIZE	3.23 (1.21)
<i>Health habits and status</i>		
Practice sports	SPORT	54.25%
Consumer must follow a special diet with medical prescription	DIETMED	21.8%
Consumers considers that suffers from health problems related to food intake	HEALTHPROB	32.5%
<i>Consumers importance when shopping to different attributes</i>		
Price	PRICE	7.85
Expiration date	EXPDATE	8.65
Presence of nutritional label	NUTRILABEL	5.44
<i>Nutrition labeling attitudes</i>		
Information provided by nutritional labels is informative and useful	INFORMATIVE	7.0
Nutritional labels offers to much information	CONFUSING	3.1
<i>List of dependent variables</i>		
Consumers' knowledge about nutrition labeling content (scale from 1 to 5; 1 = lowest, 5 = highest)	KNOWLEDGE	
Knowledge = 1		11%
Knowledge = 2		20.5%
Knowledge = 3		22%
Knowledge = 4		29%
Knowledge = 5		17.5%
Whether consumer reads nutritional labels (always and very often = 1, rarely and never = 0)	LABELUSE	37.25%
Whether consumer perceives a mandatory nutrition labeling as beneficial (yes = 1, no = 0)	BENEFICIAL	84.25%

because education's main role is assumed to be through nutrition knowledge itself (Kim et al., 2001).

To measure economic conditions and time pressure while shopping, consumers' income level and the household size are used. Income and household size indicate the economic

household situation, while reflecting a higher opportunity cost of time, which may reduce the time spent seeking out nutrition knowledge while decreasing the probability to use nutritional labels. Thus, it is expected that both variables will have a negative effect on nutrition knowledge and nutritional label use.

Furthermore, it is assumed that higher risk perceptions toward some food ingredients will induce consumer to increase their information search (Drichoutis et al., 2005). Thus, it is expected that both health variables will have a positive effect on both, nutrition knowledge and nutritional label use. In addition, whether the respondent practices sports regularly is included in the model to capture health habits.

Finally, variables measuring consumers' perceived importance of different attributes, such as, price, expiration date and presence of nutritional label when shopping are also included in the label use equation (Guthrie et al., 1995; Drichoutis et al., 2005). It is expected that consumers who think that price is important when shopping food are less likely to use nutritional labels. On the other hand, those consumers who believe that expiration date or nutritional label information is important are more likely to use it.

Results

The multivariate limited dependent variable model, defined by Eqs. (1), (3) and (5), was simultaneously estimated for the explanatory variables defined in Table 1 using the simulation estimation methods developed by Hajivassiliou and McFadden (1998). The estimation was performed using the Proc QLIM in the SAS 9.1 computer program. Estimates of the multivariate probit model are presented in Table 2.

Correlation between the error terms of Eqs. (1) and (3) and between Eqs. (3) and (5) are significant at the 5% level, but the correlation of the error terms of Eqs. (1) and (5) is not significant. Thus, simultaneous estimation of the three equations is justified.

Significant variables in the knowledge equation are: FEMALE, EDUCATION, SPORT, HEALTHPROB, and DIETMED. All of these variables except HEALTHPROB have a positive effect on knowledge of nutritional information from labels (from here on will be referred as KNOWLEDGE). All the threshold parameters are positive and significant at the 5% level, which means that the variable indeed suggests an ordered sequence. The positive coefficient associated with the FEMALE variable indicates that females might tend to gather higher information on nutrition and therefore, they think they have more knowledge than men. As expected, EDUCATION is positively related to KNOWLEDGE, suggesting that higher educated consumers think they are more informed and are more likely to think that their understanding on nutritional labels is higher. These two previous results are consistent with those found by Kim et al. (2001) and Drichoutis et al. (2005). However, these authors have also found that income has a positive impact on nutrition knowledge not found in this study. This may be due to the fact that income can be considered as a proxy of the opportunity cost of time, which may reduce the time available for gathering information on nutrition and therefore, on the level of knowledge of nutritional information on food labels. Consumers who practice sports or exercise regularly (SPORT) are more likely to believe that they have higher KNOWLEDGE on nutritional content of labels. The health status has a significant impact on knowledge through two different variables. We find an unexpected negative effect of the HEALTHPROB variable on KNOWLEDGE while the DIETMED variable has the expected positive impact. This indicates that consumers who believe that they suffer some health problem

Table 2

Estimates of the multivariate probit model

Coefficients	Knowledge		Label use		Beneficial	
	Estimates	<i>t</i> -ratio	Estimates	<i>t</i> -ratio	Estimates	<i>t</i> -ratio
Intercept	0.1598	0.76	−3.9763	−9.41	−1.31	−2.04
FEMALE	0.4694	4.44	—	—	—	—
AGE	—	—	—	—	0.0146	2.51
HHSIZE	—	—	−0.1445	−2.72	—	—
EDUCATION	0.2266	4.22	—	—	0.2275	1.85
SPORT	0.3151	3.46	—	—	—	—
HEALTHPROB	−0.2277	−2.08	—	—	—	—
DIETMED	0.2785	2.18	—	—	—	—
PRICE	—	—	−0.0706	−2.15	—	—
EXPDATE	—	—	0.0571	1.78	—	—
NUTRILABEL	—	—	0.2389	5.66	—	—
INFORMATIVE	—	—	—	—	0.1599	3.83
CONFUSING	—	—	—	—	−0.0785	−2.32
KNOWLEDGE	—	—	0.8668	13.76	—	—
LABELUSE	—	—	—	—	1.0514	3.48
N	400					
Log Likelihood	−893					
μ_2	0.7793	10.15				
μ_3	1.3895	15.58				
μ_4	2.2761	21.38				
Correlation						
Knowledge			−0.7827	−8.54	0.0513	0.52
Label use					−0.2856	−2.19

related to food intake are more likely to think that they have lower KNOWLEDGE. On the other hand, consumers who indeed have some health problem, which force them to follow a special diet based on medical prescription (DIETMED), are more likely to believe that they have higher knowledge on nutritional information from labels. Thus, only consumers who have a health problem stated by a medical doctor tend to think that they have a higher knowledge on nutritional information. However, when consumers believe that they may suffer some health problem they are not more likely to think that they have higher knowledge.

The estimated parameters for the KNOWLEDGE variable on the label use equation indicate that consumers with higher KNOWLEDGE are more likely to use nutritional labels when shopping. This result is consistent with previous studies (Guthrie et al., 1995; Kim et al., 2001; and Drichoutis et al., 2005). Thus, consumers with higher knowledge on nutrition information provided by labels are more likely to use nutritional labels. Time pressure, reflected by household size, is statistically significant. The negative expected effect of household size (HHSIZE) on label use indicates that consumers living in larger households are less likely to use nutritional labelling. This might indicate that the cost of time is higher in this type of households and that they do not spend too much time shopping. On the other hand, the importance that consumers pay to the following attributes: price, expiration date, and the presence of nutritional label are all statistically significant in explaining nutritional label use. The negative value of the PRICE coefficient indicates that those consumers who pay more attention to the price when shopping are less

likely to use nutritional labels. This finding has been also obtained by [Kim et al. \(2001\)](#) and [Drichoutis et al. \(2005\)](#) for Americans and Greek consumers, respectively. This result might indicate that price sensitive consumers pay less attention to the nutritional content of the food when shopping than non-price sensitive consumers. On the other hand, consumers who pay more attention to the expiration date (EXPDATE) and the presence of nutrition labeling (NUTRILABEL) are more likely to use the nutritional information provided by food labels.

The estimated coefficients of the benefits equation indicate that the main factor influencing consumers' perceived benefits from the mandatory implementation of a nutritional labeling is the label use. This positive estimate indicates that consumers who use nutritional labels when shopping are more likely to perceive benefits from those labels. Moreover, other factors explaining this beneficial perception are: AGE, EDUCATION and consumers' attitudes towards information provided by nutritional labels (INFORMATIVE and CONFUSING). The positive effects for AGE and EDUCATION indicate that older and more educated consumers are more likely to perceive benefits from the mandatory implementation of the nutritional label program. Moreover, consumers who consider that the information provided by nutritional labels is useful are more likely to think that the mandatory implementation of such labels will be beneficial. On the contrary, and as expected, consumers who consider that the provided information is too dense (too much) are less likely to perceive benefits from the mandatory implementation of nutritional labels.

In order to directly assess the effects of the independent variables on the KNOWLEDGE variable (ordinal variable), we estimate the marginal effects. The marginal effects on event probability can be calculated, giving a clearer interpretation of the results. In this specific case, for the continuous exogenous variables, effects are calculated by means of the partial derivatives of the probabilities with respect to the given exogenous variable.

In the case of dummy variables, the marginal effects are calculated taking the difference between the predicted probabilities when the respective variables of interest change from 0 to 1, holding the rest constant. The change on predicted probabilities gives a more accurate description of the marginal effect of a dummy variable on event probability, than predicting the probability at the mean level of the dummy variable. Marginal effects for the continuous variable (EDUCATION) and for the dummy variables are shown in [Table 3](#).

Results indicate that an extra level of education increases the probability of reporting higher knowledge about health information content. This means that highly educated consumers have more information and therefore, they think that they have higher knowledge on the information content of the nutritional label. The marginal effect of the variable FEMALE indicates that being a female increases the probability of reporting higher

Table 3
Marginal effects of the knowledge ordered probit equation

Variable	Knowledge prob ($K = 1$)	Knowledge prob ($K = 2$)	Knowledge prob ($K = 3$)	Knowledge prob ($K = 4$)	Knowledge prob ($K = 5$)
EDUCATION	−0.0403	−0.0357	−0.0093	0.0299	0.0555
FEMALE	−0.0846	−0.0749	−0.0195	0.0627	0.1163
SPORT	−0.0571	−0.0506	−0.0131	0.0423	0.0785
HEALTHPROB	0.0410	0.0363	0.0094	−0.0304	−0.0563
DIETMED	−0.0504	−0.0447	−0.0116	0.0374	0.0693

knowledge. Respondents who practice sports or exercise regularly (SPORTS) have a negative effect on the probability of reporting lower knowledge of the nutritional content of labels, while they have a higher probability of stating higher knowledge. The opposite can be said about consumers who believe having health problems related to food intake. This last group of consumers show a decreasing probability of stating higher knowledge related to the nutritional content of label. However, consumers who really have a health problem that requires them to follow a special diet with medical prescription show a higher probability of reporting higher knowledge. Thus, all effects on the probabilities are as expected, except those associated with the HEALTHPROB variable. This result might imply that consumers who only believe that they suffer a health problem related to food intake, do not regularly search for additional information, and therefore, they consider that their knowledge is lower. However, consumers who really know that they suffer a health problem because they follow a medical prescription are more interested on nutritional information and, therefore, show higher probability of reporting higher knowledge.

Concluding remarks

There is a growing consumer concern and interest in the relationship between diet and health and, in the choice of an appropriate diet because it can contribute to the prevention of some illnesses and premature death. Nowadays, the European Commission is preparing a proposal for amending the current Nutrition Labeling Directive. In particular, it is considering whether or not to make nutritional labeling mandatory. Due in part to the expected high costs of implementing the mandatory nutritional labeling, no consensus among Member States and stakeholders has been reached on the need for a mandatory implementation of nutritional labeling. Consequently, ex-ante analyses related to this topic are much needed. In particular, it is very helpful for policy makers to know whether consumers perceive any benefits on the implementation of a mandatory nutritional labeling program. To fulfill this goal, we conducted a survey among 400 shoppers in a Spanish city to assess consumers' perceptions and preferences for a mandatory nutritional labelling program (i.e., the nutritional panel label proposed in the EU regulation). We estimated a multivariate probit model in order to simultaneously model three decisions: knowledge about nutritional labels, consumers label use, and perceived benefit from a mandatory nutritional labeling program. Our results are similar to those obtained for US in previous studies. They also suggest that individuals who state to be more knowledgeable about nutritional labels are more likely to use food labels while shopping, and nutritional label users are more likely to consider a mandatory nutritional labelling program as beneficial. In addition, we have found that older and more educated consumers are more likely to perceive benefits from the mandatory implementation of the nutritional label program. Moreover, consumers who consider that the information provided by nutritional labels is useful are more likely to think that the mandatory implementation of such labels will be beneficial. On the contrary, and as expected, consumers who consider that the provided information is too dense (too much) are less likely to perceive benefits from the mandatory implementation of nutritional labels.

These results have some important implications for EU education and public nutrition programs. The findings could be used as a guide in directing education programs toward specific population subgroups. For example, public nutrition education programs could be directed towards consumers who are less likely to use nutritional labels and those who

Table A
Population by sex and age in Spain and Zaragoza

	Total	Sex ^a		Age ^a				
		Female	Male	0–19	20–34	35–54	55–64	More than 64
Spain	40,084,371	51.00	49.00	20.56	24.64	27.82	9.95	17.04
Zaragoza	614,905	51.80	48.20	18.33	29.02	29.07	10.67	17.96

Source: Spanish Census of Population, 2001. www.ine.es.

^a In percentages.

perceive the benefits of a mandatory nutritional labeling program to be low. Those who are less likely to use nutritional labels (e.g., those less knowledgeable about nutritional labels) and those who are less likely to consider mandatory nutrition labeling as beneficial (e.g., non-label users) may subject themselves and household members to unnecessary health risks if they purchase and consume foods with undesirable nutritional content.

The results of this study may also be used as a guide in the design of nutrition labeling policies. For example, our findings imply that labeling formats that are considered to contain “too much” information can decrease the probability of consumers considering such nutritional labels as beneficial. Hence, a more positive opinion about how nutritional information is provided could increase the probability of considering nutritional labels as beneficial. In line with this argument, we would argue that both the format and the amount of presented information on nutritional labels can affect consumer attitudes. Consequently, future studies should assess how much and what types of nutritional information in labels could increase consumers’ use of nutrition labels and diet quality.

Appendix

See Table A.

References

- Bush, L.M., Williams, R.A., 1999. Diet and health: new problems/new solutions. *Food Policy* 24, 135–144.
- Caswell, J.A., Ning, Y., Liu, F., Mojdzuska, E.M., 2003. The impact of new labeling regulations on the use of voluntary nutrient-content and health claims by food manufacturers. *Journal of Public Policy and Marketing* 22 (2), 147–158.
- Crutchfield, S., Kuchler, F., Variyam, J.N., 2001. Valuing the health benefits on nutrition labeling: a case study for fresh meat and poultry products. In: Presented at the 2001 Annual Meetings of the American Agricultural. Available from: <<http://agecon.lib.umn.edu>>.
- DGSanco, 2004. The Introduction of Mandatory Nutrition Labelling in the European Union. Available from: <http://europa.eu.int/comm/food/food/labellingnutrition/nutritionlabel/index_en.htm>.
- Drichoutis, A., Lazaridis, P., Nayga Jr., R.M., 2005. Nutrition knowledge and consumer use of nutritional food labels. *European Review of Agricultural Economics* 32 (1), 93–118.
- European Heart Network, 2002. Food Nutrition and Cardiovascular Disease Prevention in the European Region: Challenges for the New Millennium. European Heart Network, Brussels.
- Guthrie, J.F., Fox, J.J., Cleveland, L.e., Welsh, S., 1995. Who uses nutritional labeling and what effect does label use have on diet quality? *Journal of Consumer Affairs* 20 (2), 173–192.
- Hajivassiliou, V.A., McFadden, D., 1998. The method of simulated scores for the estimation of LDV models. *Econometrica* 66, 863–896.
- Kim, S.-Y., Nayga, R.M., Capps, O., 2001. Health knowledge and consumer use of nutritional labels: the issue revisited. *Agricultural and Resource Economics Review* 30 (1), 10–19.
- McLean-Meynsse, P.E., 2001. An analysis of nutritional label use in the southern Unites States. *Journal of Food Distribution Research* 32 (1), 110–114.

- Mojduszka, E.M., Caswell, J.A., 2000. A test of nutritional quality signalling in food markets prior to implementation of mandatory labelling. *American Journal of Agricultural Economics* 82 (2), 298–309.
- Nayga, R.M., 1996. Determinants of consumers' use of nutritional information on food packages. *Journal of Agricultural and Applied Economics* 28 (2), 303–312.
- Nayga, R.M., 1997. Impact of socio-demographic factors on perceived importance of nutrition in food shopping. *Journal of Consumer Affairs* 31 (1), 1–9.
- Nayga, R.M., 2000. Nutrition knowledge, gender and food label use. *The Journal of Consumers Affairs* 34 (1), 97–112.
- Nayga, R.M., Lipinski, D., Savur, N., 1998. Consumers' use of nutritional labels while food shopping and at home. *The Journal of Consumer Affairs* 32 (1), 106–120.
- Piedra, M.A., Schupp, A., Montgomery, D., 1996. Consumer use of nutrition labels on packaged meats. *Journal of Food Distribution and Research* 27 (2), 42–47.
- Shine, A., Reilly, S.O., O'Sullivan, K., 1997a. Consumer use of nutrition labels. *British Food Journal* 99/8, 290–296.
- Shine, A., Reilly, S.O., O'Sullivan, K., 1997b. Consumer attitudes to nutrition labelling. *British Food Journal* 99/8, 283–289.
- Szykman, L.R., Bloom, P.N., Levy, A.S., 1997. A proposed model of the use of package claims and nutrition labels. *Journal of Public Policy and Marketing* 16 (1), 228–241.
- Teisl, M.F., Boksteal, N.E., Levy, A., 2003. Measuring the welfare effects of nutrition information. *American Journal of Agricultural Economics* 83 (1), 133–149.
- Wang, G., Fletcher, S.M., Carley, D.H., 1995. Consumer utilization of food labeling as a source of nutrition information. *The Journal of Consumer Affairs* 29, 368–380.