Identifying Consumer Valuation Patterns of Alternative Nutrition and Health Labels Combinations: Evidence from Spain

By

Jesus Barreiro-Hurle, Azucena Gracia and Tiziana de-Magistris

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IDENTIFYING CONSUMER VALUATION PATTERNS OF ALTERNATIVE NUTRITION AND HEALTH LABELS COMBINATIONS: EVIDENCE FROM SPAIN [#]

Jesús Barreiro-Hurlé[a], Azucena Gracia[b] and Tiziana de-Magistris[b]

[a] Agricultural Economics Area
Andalusiam Agricultural Research Institute (IFAPA) – Junta de Andalucía
Centro Camino de Purchil
PO BOX 2027
18.080 Granada (Spain)
jesus.barreiro.ext@juntadeandalucia.es

[b] Agro-food Economics and Natural Resources Unit
Centre for Agrofood Reseach and Technology (CITA)
Avda. Montañana 930
50059 Zaragoza (spain)
agracia@aragon.es, tmagistris@aragon.es

ABSTRACT

The provision of nutrition and health information on food labels is increasing as an industry and regulation answer to the growing consumer concern with diet-health relationships. Prior research has shown that the presence of this information on food labels is valued by consumers; however there is still no clear pattern on which labelling options are more valued and how different consumers value the different options. This paper analyses the results of a choice experiment conducted to identify the effect of multiple health and nutrition information sources on consumer food choice, taking into account preference heterogeneity using a latent class approach. Results show that different consumer groups can be identified with clearly distinguishable valuation and behavioural patterns. A minority of consumers attaches high WTP to the provision of additional information in the nutrition facts panel, however this is not show for a vast majority who value claims. Moreover, not taking into account this preference heterogeneity can lead to policies that do not maximize consumer welfare. Based on the characteristics of consumers identified in each group, recommendations are made as to how both industry and public administration can move forward with the development of nutritional labelling guidelines or policies.

Keywords: Nutrition facts panel, nutrition claims, health claims, interactions, consumer, choice experiments, latent class.

Corresponding Author:
Jesús Barreiro-Hurlé
Voice: +34 958 895 260 Fax: + 34 958 895 203

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1.- Introduction

It has been shown that a significant portion of ill health is due to a combination of poor diet and low levels of physical activity. In particular, within the European context, five of the six leading risk factors for ill health are linked to nutrition: these risk factors are blood pressure, cholesterol, high body mass index, (low) fruit and vegetable intake and alcohol (WHO 2002). The link between diet and health has led to the development of a regulatory framework that is based on the premise that nutrition labelling will allow consumers to make healthier food choices and has promoted the presence of nutritional information labels on food products. Provision of nutritional and health information in food product labels is growing rapidly. The European Union's legislative framework allow the use of three different types of nutritional and health information labels on food products: nutritional facts panel (OJ, 1990), nutritional claims and health claims (OJ, 2006). Labels presenting nutrition information and claims are now commonly found on food products in the EU in general and in Spain in particular. A study sponsored by the European Commission concluded that over 50% of all food products carried a nutrition facts panel, with country specific rates varying from a low of 40% in Poland to a high of 75% in the UK (EAS 2004). A more recent review of 250 packed products in Spain reports that over 70% carried a nutritional facts panel, 43% provided nutritional claims and 23% health claims (CESNID 2007).

Despite the high expectations raised by nutrition labelling since their introduction in the 1970's, research results show that although consumers demand more information, and are even willing to pay more to ensure its presence on food products, when it was made available they did not use and/or understand it (Jacoby *et al*. 1977). Since then there has been a growing body of literature supporting the effects of nutritional and health information labels on food products on consumer attitudes towards, the valuation of, and/or purchase intention of different products (Kozup *et al.* 2003; Nayga *et al.* 2005; Garretson & Burton 2000). There is, however, still a lack of knowledge on how these effects vary according to different consumer groups and/or how to characterise these groups. The identification of homogenous groups in order to assess the impact thereof on nutrition information labels valuation is increasingly important as consumers do not value the

information presented in the form of different labels in the same manner (Verbeke & Ward 2006). Assessing how the presence of labels presenting nutrition and health claims affects consumer choice is a difficult task. Approaches based on real market data partially confirm that the presence of single labels do affect consumer choice (Mathios 1998; Kim *et al*. 2000) while for the presence of multiple labels, Adhikari *et al*. (2006) show that when a new label is presented, substitution effects take place, reducing the impact of existing one. Due to the difficulties associated with identifying the marginal effect of labelling based on observed consumption and awareness data, the majority of the studies are focused on experimental behaviour (Roe *et al*. 1999).

In a context of increasing availability of information as well as increasing concerns with diet and health, a greater understanding of the influence of multiple nutrition information labels use on consumer choice would be a research priority. This paper has as main objective to provide additional empirical evidence to support this gap in data as well as aiming to verify whether different consumer groups with regards to nutrition label valuation can be identified. Using a choice experiment of Spanish consumers, this paper evaluates the preference for labels on food products providing nutrition and health information. The experimental design employed allows an estimation of not only the effect of a single label on consumer choice, but also that of the joint provision of two different labels. The use of a latent class modelling approach will also focus on the heterogeneity in preference issue, identifying different consumer groups according to their labelling preferences and characterising the different members of each group.

2.- Literature Review

Health is a credence attribute that cannot be revealed to the consumer even after purchasing[1]. Therefore to allow for choice taking into account this attribute, additional credible information on the unobserved characteristics must be provided to consumers, i.e. those related to health and nutrition. For food products, one way of doing this is providing health and nutrition information

[1] As Roosen *et al*. (2007) point out, health and nutrition attributes are considered credence attributes because they are only experienced after a very long period of time and capacity of consumers to identify their impacts depend on public and private information policies.

on labels. The objective of these credible signals (i.e. facts panels or claims) is to inform and persuade consumers about the healthiness of the food product in order to help them make choices that better reflect their health preference. A large number of empirical studies have been conducted to analyze the relationship between consumers and the different nutrition information labels on food products. However, most of them have focused on consumer understanding as well as the use of the nutrition facts panel label and the health and nutrition claims[2]. Only a minority of studies have been conducted to assess the effect of different nutrition and health labels and/or claims on consumer food choice and/or how much consumers value their provision. Roe *et al*. (1999), Garrestson & Burton (2000), Kozup *et al.* (2003) and Basil *et al.* (2005) studied the effect of two different nutrition and health information labels (facts panels and claims) on consumer food product evaluations, consumer attitude towards products and purchase intentions. Roe *et al*. (1999) studied the effect of ten different nutrition and health claims on consumer health evaluations and intention to purchase for three food products. Their results indicate that when a food product carries a health and, to lesser extent, a nutrition claim, consumers view the product as healthier and state they are more likely to purchase it. Garretson & Burton (2000) studied the effects of nutrient information contained in the nutrition facts panel and nutrition and health claims on consumer attitude and purchase intention. Results indicate a stronger effect for the nutrition facts panel than for claims on consumer intention to purchase. Kozup *et al.* (2003) carried out the same type of analysis distinguishing between food products and restaurant menus. Findings indicate that a health claim can have a favourable effect on product attitude and purchase intention in both cases. The use of heuristics to understand nutritional information is the subject of the study by Basil *et al.* (2005). They analyze the effect of specific health and nutrition labels on consumer food decisions in Canada concluding that when individuals use a heuristic to read a nutrition label, they make more accurate food decisions. In other words, consumers prefer using shorter nutrition and health information when they take the final food product decision reducing the time spent on food choices. Finally, Bond *et al.* (2008) use a choice experiment to estimate the WTP for a number of health and nutrition claims and some production process attributes for a packaged red leaf lettuce. Results showed that specific health claims were more valued by consumers than general health claims.

[2] A revision of these studies can be found in Cowburn & Stockley (2005), Williams (2005), Drichoutis *et al.* (2006) or Grunnert & Wills (2007).

The current paper is in line with the last study, but it expands on its objectives by identifying consumer groups with different label valuation behaviour. The paper evaluates how much value consumers place on the provision of a detailed nutrition label, a nutrition claim and a health claim respectively when shopping. In addition, this paper analyses the potential interaction between the different labels in consumer choice and identifies homogenous consumer groups with regards to label valuation. This analysis has not been covered by the literature on the impact of nutrition labels on food choice to date and we believe the findings could be of interest to both policy makers and industry.

Consumer characterization with regards to nutrition label use has been broadly analysed in the literature. A review of these studies allows us to identify a core group of factors that determine nutritional label use: nutrition knowledge; individual characteristics; economic circumstance and time pressure; health concerns, habits and status; product involvement; and other factors, such as searches for product information and lifestyles. A majority of studies assessing the impact of nutritional knowledge on nutrition label use found a positive effect, which indicates that consumers with higher nutritional knowledge are more likely to use nutritional labels when shopping (Guthrie *et al*. 1995; Szykman *et al*. 1997; Kim e*t al*. 2001b; Drichoutis *et al.* 2006).

As far as individual socio-demographic characteristics are concerned, gender, age, and education have been identified as the main determinants of nutrition label use. Women (Guthrie *et al.* 1995; Jensen *et al.* 1996; Govindasamy & Italia 1999; Kim *et al*. 2000; Kim *et al*. 2001a, Kim *et al.* 2001b; McLean-Meyinsse 2001; Drichoutis *et al.* 2006) and older people (Nayga 1996; Kim *et al*. 2000; Lin & Lee 2003; Govindasamy & Italia 1999; Drichoutis *et al.* 2005; Drichoutis *et al.* 2006) are more likely to use nutrition labels. Nutrition label use is also positively associated with education (Guthrie *et al.* 1995; Wang *et al.* 1995; Nayga 1996; Govindasamy & Italia 1999; McLean-Meyinsee 2001; Drichoutis *et al.* 2005).

Economic circumstances and time pressure while shopping are captured using consumer income level and household size as proxies. Higher income and household size reflect a higher opportunity cost of time, which may reduce the probability of using nutritional labels. However,

empirical evidence does not clearly support this expectation, as some studies have found that income has a positive influence on nutritional label use (Wang *et al.* 1995; Piedra *et al.* 1996; Nayga 1996; Kim *et al*. 2000; McLean-Meyinsse 2001; Kim *et al.* 2001a), while others found this influence to be negative (Schupp *et al.* 1998; Drichoutis *et al.* 2005). This is probably due to the fact that income does not only reflect time constraints but also can serve as a proxy for a myriad of other social or cultural characteristics. There is also lack of consensus regarding the effect of household size on nutrition label use; while a negative effect is reported by some studies (Guthrie *et al.* 1995; Govindasamy & Italia 1999; Drichoutis *et al.* 2006; Gracia *et al*. 2007) a positive effect has also been found (Wang *et al.* 1995; Nayga 1996).

With regards to individual health concerns, several studies show a positive effect of consumer health awareness and status on the search for nutrition information. Thus, it is expected that health-related variables will have a positive effect on nutrition label use (Shine *et al*. 1997; Wang *et al*. 1995; Kim *et al*. 2000; Kim *et al.* 2001a; Kim *et al.* 2001b; Drichoutis *et al.* 2005; Gracia *et al.* 2007). Consumer perception of the importance of different food attributes when shopping such as price, nutrition, taste and convenience, have also been found to affect nutrition label use. Consumers who think that price is important when shopping are less likely to use nutrition labels (Nayga *et al.* 1998; Drichoutis *et al.* 2005; Gracia *et al.* 2007). On the other hand, those consumers who believe that nutrition is an important factor when making food choices are more likely to use them (Jensen *et al.* 1996; Nayga *et al.* 1998; Nayga 2000; Kim *et al*. 2000; Gracia *et al.* 2007). The effect on label use of the importance of taste when shopping is expected to be negative (Guthrie *et al*. 1995; Nayga *et al.* 1996; Drichoutis *et al*. 2005) although some empirical studies have found a positive impact (Jensen *et al.* 1996; Nayga *et al.* 1998; Nayga 2000).

3.- Methodology

In order to achieve the paper's objectives, a choice experiment (CE) was undertaken, using as relevant product attributes the presence of the different types of nutrition and health information and price. This methodology is used for a number of reasons: its ability to value multiple attributes simultaneously, the consistency of CE with random utility theory, and the similarity of

the hypothetical choice to real market decisions (Lusk *et al.* 2003; Adamowicz *et al.* 1998). In the choice modelling approach consumers choose between alternative products that contain a number of attributes with different levels in order to maximize their utility. Utility is assumed to be known by the individual but some of its components are unobserved by the researcher. Thus, utility is taken as a random variable where utility from the n^{th} individual facing a choice among *j* alternatives within choice set *J* in t^{th} choice occasions can be represented as,

$$U_{njt} = \beta X_{njt} + \varepsilon_{njt} \qquad [1]$$

where β is a vector of parameters to estimate and ε_{njt} is an independent identically distributed (i.i.d.) error term over time, people and alternatives. Traditionally, it has been assumed that consumers were homogeneous in terms of taste and conditional logit models were fitted (McFadden, 1974). However, as our objective is precisely to understand consumer heterogeneity we need to allow the taste parameters of observed variables to vary in the population. Two alternatives have gained popularity in choice modelling literature when addressing this issue of heterogeneity: random parameter logit model (RPL) and latent class logit model (LCM) both of which are version of a mixed logit model (Hynes *et al.* 2008; Colombo & Hanley 2008). The RPL has been widely used in several applications of discrete choice modelling in different disciplines and in particular, in agro-food marketing (Rigby & Burton 2005; Kaye-Blake *et al*. 2005; Barreiro-Hurlé *et al*. 2008). Heterogeneity is incorporated in the approach considering each individual to have a unique set of preferences and estimates of the utility function. When estimating the choice model, an additional vector of parameters is included to incorporate individual preference deviations with respect to the mean preference values[3]. However, if preferences are assumed not to be "unique" for each individual but rather distinct for a determined number of individual classes, the LCM better suit the modelling of choices. In this model consumers are assumed to belong to different segment or classes, each of them characterised by different class-specific utility parameters. In other words, within each segment, consumer's preferences are homogenous but preferences vary between segments, reflecting a "lumpy" spread preference and allowing for a more in depth understanding of heterogeneity

[3] β in [1] is not constant but varies across individuals, β_n.

(Hynes *et al*., 2008). This modelling approach has also been used to better understand consumer preferences for agricultural products, allowing identifying distinct pattern of valuation and behaviour (Hu *et al*. 2004; Kontoleon & Yabe 2006; Nilsson *et al.* 2006).

Then, in the LCM, utility of the individual n choosing alternative *j* in the t^{th} choice occasion is:

$$U_{njt|s} = \beta_s X_{njt} + \varepsilon_{njt|s} \qquad [2]$$

where $\boldsymbol{\beta}_s$ is the parameter vector of class *s* associated with the vector of explanatory variables X_{nti}, $\varepsilon_{njt|s}$ are error terms that follow a Type I (or Gumbel) distribution. Then, the choice probability that individual *n*, conditional to belonging to class *s* (s=1,…..,S), chooses alternative *i* from a particular set *J*, comprised of *j* alternatives, in a particular choice occasion *t*, is represented as:

$$P_{nit|s} = \frac{\exp(\beta'_s x_{nit})}{\sum_{j=1}^{J} \exp(\beta'_s x_{njt})} \qquad [3]$$

The allocation of individual *n* to the *s* class, probability of class *s*, is unknown and various formulations have been used. For this application, the convenient multinomial logit is assumed (Greene & Hensher 2003):

$$P_{ns} = \frac{\exp(\alpha'_s Z_n)}{\sum_{s=1}^{S} \exp(\alpha'_s Z_n)} \qquad [4]$$

where Z_n are individual-specific characteristics and α'_s the class-specific utility parameters.

We assume that, given the allocation of individuals into classes (segment membership), the t^{th} choice occasions are independent (Greene and Hensher, 2003). Thus, for the given segment membership, the choice probability that individual *n*, conditional to belongs to class *s*

(s=1,…..,S), chooses alternative *i* from a particular set *J*, comprised of *j* alternatives is represented as:

$$P_{ni|s} = \prod_{t=1}^{T} P_{nit|s} \qquad [5]$$

In order to derive a model that simultaneously accounts for choice and segment membership the models of equations [4] and [5] are brought together to construct a mixed-logit model that consist of the joint probability that individual *n* belongs to segment *s* and chooses alternative *i*:

$$P_{ni} = \sum_{s=1}^{S} P_{ns} \prod_{t=1}^{T} P_{nit|s} \qquad [6]$$

Then, the number of segments can be endogenously determined jointly with the utility coefficients. The latent class model has been estimated using NLOGIT 3.0 (Greene 2002). This software maximizes the log likelihood function using the Newton algorithm and the estimated asymptotic covariance matrix is based on the second derivatives. In order to assure that the results obtained reflect a global maximum, starting values for the iterations are obtained by assuming the classes are equally probable, but the class specific vectors are slightly from the Multinomial Logit estimates as not doing so would like to convergence at local maxima.

4.- Data

Data were collected from a survey conducted in two medium-sized Spanish towns, Cordoba and Zaragoza, during March and April 2007. These towns were selected to be representative of both, the North (Zaragoza) and the South (Cordoba) of the Country while having socio-demographics

similar to the Spanish Census of Population[4]. In each town 400 consumers were interviewed. For an infinite population and assuming a confidence level of 95.5% (k=2) and p=0.5 the error is ±5%. The final sample in each town was selected using a stratified random sample of consumers on the basis of town district and age. Target respondents were the primary food buyers in the household and the questionnaire was delivered face to face. Interviewers approached randomly selected individuals asking them two screening questions: whether they were the main household food shopper and whether they consumed pork Frankfurt sausages. In the case of a negative response to either of the screening questions, the interviewer randomly selected another customer belonging to a given age group, until finding a participant matching both requirements.

In the questionnaire consumers were asked questions related to health, diet and food safety attitudes, nutritional knowledge, food label use and pork Frankfurt sausages consumption patterns[5]. The questionnaire also contained questions on socio-demographic characteristics (i.e. gender, family size and composition, age, education and income level) and lifestyles. Finally, participants had to respond to the choice set question described in the next section.

Summary statistics for the characteristics of the full sample as well as for the independent variables used for characterising the identified classes are presented in table 2.

[Table 2 around here]

The majority of respondents were female (72%), with an average age of about 45 years, living in a household with an average of three members. Around 52% of respondents stated that they had a net household monthly income between €1,500 and €3,500 and over one third of the sample has followed university studies. Finally, the proportion of households with children younger than six years old was 19%. Consumers were asked whether they suffer or have suffered health problems related to food intake (HEALTH_PROB) and whether they undertake annual health checks ups (CHECKUPS). Close to one third of total respondents state that they suffer of have suffered health problems and nearly half said that they follow annual check ups. Trust in nutrition information was

[4] However, both study areas are urban and thus our results cannot capture possible differences in rural and urban consumer behaviour.
[5] The questionnaire is available from the corresponding author upon request.

measured asking consumers to rate their level of trust using a 10-point increasing scale on different nutrition information sources: labels on food products (TRUST_LABELS) and public administration (TRUST_ADMIN). Respondents place more trust in information sourced from public administration than in that provided by food product labels. Knowledge regarding nutrition and what healthy eating means is measured by two variables. Consumer knowledge of the meaning of a healthy diet was measured by asking respondents to rate the extent to which different eating behaviours could be regarded as healthy using a 10-point increasing scale. As the rating of some of the eating behaviours was highly correlated with that of others, instead of using them directly as explanatory variables, a factor analysis was carried out to identify the underlying factor defining consumer knowledge of healthy diet (KNOW_HEALTHY) and was included as an explanatory variable in the model (see table A.1 in Appendix). Nutritional knowledge was measured using an "objective knowledge" perspective as an alternative to declared self-assessed nutritional knowledge measures which can suffer from bias. Building on the scale proposed by Drichoutis *et al.* (2005) and its replicate in Spain (Barreiro-Hurlé *et al*. 2008), three questions were put to all interviewees. Two of them were pair-wise comparisons regarding nutrient content in different food products, that requested consumers to indicate which product had more cholesterol (butter or margarine) and which product had more fat (fried chicken or boiled chicken). The third was an open-ended question designed to elicit the number of daily servings of fruit and vegetables recommended by the health authorities[6]. Answers to the three questions were used to create a knowledge index constructed as follows. Individuals who gave correct answers to all three questions were given a KNOWLEDGE value of three: those who gave correct answers to both pair-wise comparisons for specific nutrient content in foods and provided a close estimate of the recommended number of fruit and vegetable servings (i.e. 4 or 6) got a KNOWLEDGE value of two; individuals who correctly answered both pair-wise comparisons for specific nutrient content in foods[7] were assigned a KNOWLEDGE value of one and those who did not provide any correct answers were given a KNOWLEDGE value of zero. KNOWLEDGE is thus an ordered variable which ranges from zero to three, and the descriptive statistics for this variable are presented in table 2.

[6] At European level, a major promotional campaign has been in place for the past three years to encourage the daily intake of five servings of fruit and vegetables (i.e., www.5aldia.es for Spain, www.5aday.org for the UK).

[7] Parmenter & Wardle (1999) state that individual items with more than 80% of correct answers are not useful for nutritional knowledge scales. The fat-related pair-wise comparison, obtained a percentage of correct answers well above this threshold (98.5), while grouping allows correct answers to provide more information about individuals nutritional knowledge (percentage of correct answers for the combined fat-cholesterol-related pair-wise comparisons = 66.75).

Consumers were asked to rate the importance they give to various food attributes when shopping. Importance was rated on a 10-point increasing scale. As the importance attached to each attribute was highly correlated among them a factor analysis was carried out to identify the main underlying factors to be used as explanatory variables instead the original ones (see table A.2 in Appendix). A factor related to nutrition-related attributes (NUTRITION) was identified and is used as a proxy for product involvement. Finally, information was also gathered regarding consumers' lifestyles asking them their level of agreement with different statements on a 10-point increasing scale. To avoid the high correlation of responses a factorial analysis were previously done (table A.3 in Appendix). Two factors were identified, one related to healthy lifestyles (LS_HEALTHY) and another focused on more hedonistic behaviours (LS_HEDONISTIC).

5. Choice set design

The first selection to be made in the choice design was that of attributes and levels. Besides price, the attributes selected are the three different nutritional and health labels targeted for evaluation. The nutrition facts panel label levels selected present the two options that are defined in the European regulation whereby the basic panel contains the four nutrients that EU regulation considers as basic (DG SANCO 2006) while the detailed one presents additional information consumers may value and that is can be currently found on some sausage brands. Among the possible nutrition and health claims that could be used (i.e. on fat, cholesterol), claims related to fat content and their health effects were chosen as this seems to be one of the most relevant nutrients for consumers. Over 50% of consumers who declare to have changed their eating habits at the EU level stated that they try to reduce their fat intake (EC 2006). Moreover, consumers pay more attention to claims related to negative nutrients than to claims for positive nutrients, and fat is the most salient nutrient in the nutrition facts panel (Keller *et al.* 1997). Pork Frankfurt sausages were chosen because they fulfil three conditions: *i)* consumers are very familiar with them; *ii)* they are frequently consumed; and *iii)* they are a non luxury product, thus most consumers can afford them.

A description of the experiment was presented to participants, indicating the selected attributes for each of the products: price per package, nutrition facts panel label, nutrition claim and health claim. The different levels of the selected attributes are presented in table 1. Choice sets include three alternatives: two unlabeled alternatives consisting of different products (two sausage packs) and a no-buy scenario and was presented using mock packages as shown in figure 1.

[Table 1 about here]

[Figure 1 about here]

The price vector chosen reflects the current price levels found in Spanish supermarkets with the upper limit including a 50% premium. The nutrition claim studied is a "low fat content" type of claim. A 30% fat reduction was considered in order to comply with the EU regulation on nutrition and health claims made on foods and technical feasibility (Ruiz *et al*. 2006). The health claim is related to cardiovascular diseases. Given that there is sufficient scientific evidence to support the link between fat intake and cardiovascular disease, this claim could be put forward for approval by the European Food Safety Authority (Hooper *et al*. 2001).

The choice set design was created following Street & Burguess (2007). As the research objective is to come to an estimation of the main and two-way factor interactions effects, a full factorial design was generated. The complete factorial design results in 32 runs. We then used these 32 profiles to obtain suitable pairs. The optimal design consists of choice set in which the number of attributes that differ between any pair of profiles in the choice set is $(k/2)+1$ where k is the number of attributes. Thus, the level of three attributes in each element of the choice set (32) was systematically changed for three attributes, leaving the level of the fourth attribute unchanged. Following this procedure, 92 pairs were obtained which resulted in a final number of 80 after removing repeated choice sets. This design is 97.5% efficient. To avoid fatigue effects associated with multiple scenario valuation tasks, the 80 choice sets were randomly split into 20 blocks. Thus, each respondent was asked to make choices for one block of four choice sets[8].

[8] Because the interview was conducted face to face, some social desirability bias could have been presented although we expected that it was small taken into account that to report less healthy choices is not really a socially unacceptable behaviour. However, the presence of such a bias cannot be ruled out for other items in the survey such as attitudes as behaviour.

6.- Model Specification and Estimation Results

In the LCM, two groups of variables require further specification, those that enter the utility function and those which explain the segment allocation function. The utility function is comprised of the analysed attributes and one alternative-specific constant representing the A and B choice option (ASC). Individual characteristics were not included in the utility portion of the model given these characteristics impact primarily on the segment membership function (Kontoleon & Yabe 2006). It is expected that the alternative-specific constant would be positive and significant, indicating that consumers will gain a higher utility from choosing any alternative than from the no-buy option C. The nutrition facts panel (NPANEL), nutrition claim (NCLAIM) and health claim (HCLAIM) variables are effect coded and the price (PRICE) represents the price levels given to consumers for each food product. Interactions between the three nutrition and health attributes (NPANEL&NCLAIM; NPANEL&HCLAIM and NCLAIM&HCLAIM) have also been included as the experimental design allows for identification of main effects and two-way interaction effects. Price is expected to have a negative impact on utility, while identifying the effects of the other variables is part of this paper's objective.

For the specification of the segment membership function, the explanatory variables studied are defined in table 2. These variables were selected using the results of the literature review outlined above and based on relevance for the explanation of different nutrition labels use. One of the key issues in latent class modelling is the selection of the number of segments to consider. To determine the optimal number of segment four criteria were used: the minimum Akaike Information Criterion (AIC), the modified Akaike Information Criterion (AIC3), the minimum Bayesian Information Criterion (BIC), and the maximum of $\bar{\rho}^2$ called the Akaike Likelihood Ratio Index (Hu *et al.* 2004). The results of these criteria for the different number of segments are presented in table 3, allowing for the identification of up to five segments.

[Table 3 around here]

The results from table 3 show that the log likelihood at convergence, the AIC, the AIC3 and the BIC decrease up to the three-segment specification, slightly increase when considering four segments and decrease again when introducing a fifth one. However, the $\bar{\rho}^2$ increases up to the three segment specification, decreases when introducing a fourth segment and increases again when considering five. The optimal number of latent segments was selected by looking at these multiple statistical criteria whilst also assessing whether additional segments provide any further economic information, with the overall aim of attaining segment parsimony (Swait 1994). Although the values of the different criteria for the five segment specification are slightly better than that of the three segment one, the last two segments in the former specification are small and with few significant variables in their segment allocation function, and therefore the three segment specification was selected.

The results for the LCM model with three segments are presented in table 4, and the parameters estimates for a one-segment model are included for comparison. The final explanatory variables to be included in the segment membership function were chosen based on the results of the estimation. Initially all the individual characteristics variables defined in table 2 were applied. Following, some were excluded as they were found to be statistically non significant while others gave an estimated asymptotic covariance matrix not positive definite. The seven variables finally selected for inclusion in the membership function are those that are considered statistically significant and that allowed for appropriate estimation. Hu *et al*., (2004) encountered similar problems and chose to estimate a latent class model including only one constant in the segment membership function. However, in our case it was possible to estimate a model with seven of the fifteen individual characteristic variables which has statistically outperformed one with only a constant term[9] and, thus, this model was selected (table 4). When coming to the characterisation of the segments we did choose to also investigate whether the variables not included in the membership function could help explain individual class probabilities of belonging to each segment.

[Table 4 around here]

[9] The Likelihood Ratio test calculated between both models is 76 which is greater than the χ^2_{14} indicating that the unrestricted model is not rejected at the 5% significance level).

Confronted with the no-buy option, consumers choose either product A or B in 98% of the cases, a result which reflects that generally they derive a higher utility from purchasing sausages than from not, which is not surprising considering the sample selection focused on product consumers. Most of parameters in both the utility and the segment allocation functions are statistically significant, with an Akaike Likelihood Ratio Index ($\bar{\rho}^2$) equal to 0.4 which indicates that the fit of the model is good (table 3). As the segment membership coefficients for the third segment were normalised to zero in order to identify the remaining coefficients of the model, all other coefficients must be interpreted relative to the third segment.

When considering the one-segment model we see that, as expected, the effect of the price in the utility function is negative indicating that increments on the price decrease the choice's associated utility level. The positive value of the parameter estimate for each of the nutrition and health labels indicated that the utility for the package of sausages with each label is higher than the utility derived by the package of sausages without those labels. Similarly, the positive value of the parameter estimate for the interaction between the detailed nutrition facts panel label and the claims (NPANEL&NCLAIM and NPANEL&HCLAIM) indicates that the utility derived from a package of sausages with both labels is higher than the sum of the utilities associated with the presence of each label in isolation. On the contrary, the negative value of the parameter estimate for the interaction between claims (NCLAIM&HCLAIM) shows that the utility derived from a package of sausages with both claims labels is less than the sum of the utilities for the labels in isolation. It should be taken into account that the results of this model may not be representative of individual behaviour of individuals, as it can be seen from the analysis of the attribute parameters for the different segments identified in the LC modeling. Only the price parameter is consistently negative both for all classes in the LCM and the results of the one-segment model.

The first segment consists of 41% of respondents. The segment membership function coefficients indicate that the probability of belonging to this segment is positively influence by knowledge of healthy eating (KNOW_HEALTHY), income (INCOME) and education (UNIVERSITY), although these last variables only show a 10% significance level. Similar to the one-segment model, consumers in this segment positively value the three analysed nutritional labels in

isolation, although higher utilities are associated with the claim format (NCLAIM and HCLAIM). The presence of more than one label has an additional positive utility effect only when both labels refer to the same type of information, i.e. nutrition, as shown by the positive sign of the NPANEL&NCLAIM parameter. The negative estimated parameter for the interaction between claims (NCLAIM&HCLAIM) indicates that consumer utility for the joint provision of both labels is lower than the sum of the utilities derived by each of them individually.

The second segment is the smallest, consisting of only 7% of respondents. In this segment the membership function coefficients indicate that the probability of belonging to this segment is positively influenced by knowledge of healthy eating (KNOW_HEALTHY), education level (UNIVERSITY), whether the respondent suffered health problems related to food intake (HEALTH_PROB) and the presence of children in the household (CHILDREN). On the other hand, it is negatively affected by the income level (INCOME) and consumer trust on labels as a source of information (LABEL_TRUST). The estimate parameter for the individual provision of a detailed nutrition facts panel label is positive while the individual provision of each of the claims is negative. This means that the utility derived from a package of sausages with a detailed facts panel label is higher than that from a package without this label. On the contrary, the utility derived from a package of sausages with only one of the claim labels is lower than the utility derived when these labels are not present on the product. The estimated parameters for the interaction between the nutrition claim and the other two labels (NPANEL&NCLAIM and NCLAIM&HCLAIM) are positive indicating that the utility derived from a package of sausages with the nutrition claim combined with the one of the other two labels is higher than the utility derived from the package with only the nutrition claim.

The last segment is the biggest one consisting of 52% of respondents. Although segment membership coefficients for this segment cannot be estimated, the characteristics can implicitly be derived from the coefficients estimated for the other two segments if they are both negative and positive. Thus, the probability of respondents belonging to this segment is negatively influenced by the parameters knowledge on healthy eating (KNOW_HEALTHY) and education level (UNIVERSITY). This indicates that respondents in this segment present lower knowledge on healthy eating and lower education level. The parameter for the individual provision of a

nutrition claim is positive and that for the facts panel and health claim is negative. The utility derived from the package of sausages with a nutrition claim is higher than that derived from the package without this claim, whereas the utility derived from a package of sausages with a detailed nutrition facts panel or health claim is lower than the utility from a package without those labels. Finally, the estimate parameters for the interaction between the nutrition claim and each of the other labels are negative (although not statistically significant in the case of the detailed facts panel), indicating that the utility decreases when a package of sausages has both claims.

The interpretation of direct estimate parameters is not enough to fully understand consumer valuation patterns and how these can be interpreted. Therefore the marginal values or willingness to pay were calculated for the main effects of the attributes (NPANEL, NCLAIM and HCLAIM) and for the total effects that include the interaction factors terms (table 5). The WTP is calculated by determining the price difference that generates utility equivalence between food products with nutrition and health information and without this information. Mean WTP values for individual attributes are calculated by taking the ratio of the mean parameter estimated for the nutrition and health attributes to the mean price parameter multiplied by minus one for each class. The formula use for the calculation of the total WTP when interactions are taken into account are shown at the bottom of table 5.

[Table 5 around here]

From these results we can conclude that consumers in the first segment place more value on labels which are simple and straight forward to understand (HCLAIM and NCLAIM) and among these, would be more willing to pay for the health claim label. However, when the health claim label is provided together with another label providing additional information, i.e. detailed nutrition facts panel or nutrition claim, the total WTP is lower than the sum of individual WTP. This indicates that combining the health claim label with other nutritional labels has a negative impact on consumer valuation for this segment. Therefore this segment can be denoted as "*health claim seekers*", because the consumer attaches a higher value to the provision of this label in

isolation (HCLAIM) than to the provision of any other label (NPANEL or NCLAIM) or combination thereof (NPANEL&HCLAIM and NCLAIM & HCLAIM).

The second segment attaches positive WTP only to the provision of objective information on nutrition content (nutrition facts panel) and they strongly dislike the provision of information in the form of claims either in isolation (NCLAIM and HCLAIM) or together with the facts panel (NPANEL&NCLAIM and NPANEL&HCLAIM). The size of this negative preference for claims is so strong that it leads to a negative total WTP for the detailed facts panel if its presented in combination with either claim. Then, this consumer segment can be labelled as *"facts seekers"*.

The third segment attaches a positive WTP to the provision of nutritional claims, a negative to the provision of detailed nutrition facts panel and does not place a value on the provision of a health claim if present in isolation. When more than one label is presented, a detailed facts label combined with health claims is associated to a positive price premium overcoming the negative valuation attached to the detailed facts information in isolation. This could reflect an increase on consumer trust in the health claim when more facts are provided, even when the consumer might not understand them as shown by the negative value attached to this attribute. However, we see that consumers in this group attach the highest WTP to the provision of nutrition claims in isolation followed by the provision of this claim together with the detailed facts panel label. Then, this segment can be labelled as "*nutrition claim seekers*".

7.- Segment characterization

Two different approaches have been used to characterise the segments identified in the choice modelling. First, we examined the estimated parameters for variables which have been found significant in the segment membership function as shown in equation [4] (lower rows in table 4). An additional approach to characterise the identified segments is to conduct a bivariate tests analysis. As mentioned before, the rest of hypothesized variables that could characterise consumers according to nutrition and health information label use (table 2) have been used in the bivariate analysis between them and the consumer membership of each segment as the grouping variable. Moreover, these analyses have been undertaken for the variables which have been found

to be significant in the segment membership functions. Results for these tests are shown in tables 6 and 7.

[Table 6 around here]

[Table 7 around here]

The "*facts seekers*" segment places a significant lower trust in information provide by labels and by health authorities when compared with the other two groups. This lower level of trust is combined with a higher level of knowledge measured, showing an understanding of what a healthy diet means (KNOW_HEALTHY) as well as higher objective nutritional knowledge (KNOW_NUTRI)[10]. This group also has lower time constraints as measured by lower income and smaller household size. In addition, the presence of children in the household and that of people claiming diet related health problems is higher, characteristics that would indicate an increased need for more detailed nutrition information when shopping. Finally, this group has an over representation of men, nearly doubling the average of the full sample. This segment would benefit most from an extension of the nutrition facts regulation to expand the list of nutrients for which information is presented in the facts panel. However, we must take into account the size of this segment is very small indicating that their relative share in total population is very low.

The, "*nutrition claim seekers*" are however characterised by a lower level of knowledge as to what a healthy diet means (KNOW_HEALTHY) and place higher levels of trust in labels on food and in public administration (TRUST_ADMIN). The importance they attach to the nutritional attributes of the food product when shopping (NUTRITION) is the lowest and they follow the least healthy lifestyle. Moreover, consumers in this segment show higher time pressures and better economic circumstances as shown by the facts that they tend to live in larger households and have a higher income level than those in the other segments. As far as health status is concerned, this segment suffers less diet-related health problems and does not check their health status regularly as a preventive measure.

[10] As shown by the higher percentage of consumers in this segment scoring high in the nutritional knowledge variable reported in table 7.

The "*health claim seekers*" segment shares some characteristics with the other two groups described previously. They have average nutrition knowledge yet they place the highest level of trust in labels on food and in public administration. Although they have experienced fewer diet-related health problems and they tend to follow a healthy lifestyle with regular health status checks they do not totally avoid more hedonistic habits. This segment faces important time constraints and relatively good economic circumstances as measured by the highest levels of income and the completion of university studies, as well as by the larger household size, albeit a significantly lower presence of children.

8.- Discussion

The inclusion of nutrition and health related information on food labels is currently one of the most important developments in food marketing. Using a stated preference valuation methodology this paper has presented an estimate of how the consumer values this attribute allowing for preference heterogeneity among consumer groups. The results presented show that consumers place a value on food labels but the preference for nutrition labels do indeed show a "lumpy" heterogeneity with significant differences between the three segments identified in the empirical application. The results underline not only differences in valuation intensity but also in the direction of those preferences, identifying options which could carry a positive price premium for some consumers and a negative one for those in another consumer segment. A consistent finding is that all three consumer segments derive the highest levels of utility from (attach the highest WTP to) the presence of a single labelling option (HCLAIM, NPANEL or NCLAIM)[11]. This finding is even more relevant when considering that the single segment modelling approach signals multiple labelling strategies (NPANEL&HCLAIM) as the most valued.

[11] Our experimental design following current legislation implies that whenever claims are present a basic nutrition facts panel will also be present, when we mention that single labelling options are preferred we are referring to the three additional labelling options available, i.e. more detailed facts panel and basic facts panel with nutrition/health claims.

The reported results have interesting implications for both industry and public administration. Of relevance for industry developments is the finding that too many labels should be avoided. Consumers tend to place the highest value on a product including one single source of information regarding nutrition and health issues. A positive WTP is attached to claims by a larger percentage of consumers, as they allow more consumers to understand the benefits provided by the product. Moreover, a significant portion of consumers has a negative preference for this type of information which they do not understand and/or consider beneficial. A successful labelling strategy should therefore likely focus on more clear-cut and direct messaging in the form of claims. To reinforce this it would seem that the provision of additional information is only highly valued by a minority of consumers.

Based on the findings of this paper nutrition claims would provide a more balanced market acceptance than health ones, taking into consideration the strong rejection results this labelling option obtained for the "*facts seekers*" segment. However, this finding can be contingent in the product choice as this consumer group has higher nutrition knowledge and thus can consider that there is no such thing as a "low-fat" sausage, perceiving the claim as false and attaching a negative value to it. Additional support to this conclusion can be found in the fact that even when either of these claims is combined with the provision of a detailed facts panel, global product valuation is negative for this segment. However, as specific claim approval is a lengthy and costly process, the WTP values obtained should be compared with the associated costs of the administrative process, before concluding that multiple nutrition and health labelling strategies are profitable from a private perspective. Findings reported seem to support the profitability of the undertaking, however until costs are estimated, no definitive answer can be provided.

The relevant implications for public policy can be derived from the identification of different consumer groups and, in this case, the characterisation of the individuals within them, to date this has not been studied and the results, if substantiated, support a change in the legislative framework. Mainly, efforts aimed at increasing the provision of nutrition information in the form of facts panel will only be valued by a majority of consumers if the overall population nutrition knowledge levels are increased. Yet more than half of the population (the "*nutrition claim seekers*" segment) will not perceive these efforts as beneficial and will even avoid purchasing

products, *ceteris paribus*, with lengthy and, for them, incomprehensible information. Moreover, this consumer group is the one less likely to follow healthy eating habits and will pay less attention to nutrition when purchasing food and more generally in their daily lives. Thus, this segment is probably at the highest risk for diet-health diseases, something that can be observed in our data set, as more health related problems are reported in this group than in the others.

Providing a rigorous legal framework for inclusion of nutrition and health claims, will allow a wider audience to be reached with this information and thereby have a more homogenous impact on consumer choice. The most widely accepted claim would be a nutrition claim; however this claim will carry a negative premium for the "*facts seekers*" segment. Health claims would not lead to a similar high rejection; however the "*nutrition claim seekers*" segment would not see their choices affected by this label. Another interesting policy option would be to increase the amount of information in the facts panel when claims are present. Firstly it may influence choice behaviour of the "*nutrition claim seekers*" segment, who, although not in isolation, value health claims if accompanied by this additional information; secondly it would reduce the intensity of the rejection of the "*facts seekers*" segment. Moreover, this additional information would benefit overall consumer nutritional knowledge, as facts could be associated with specific benefits. The potential for this information to be translated into knowledge is higher for both claim seeker segments as they have lower levels of knowledge and show the highest trust in labels and the administration. However, sound scientific base would be needed as to which claims are allowed, as too many claims could lead to a loss of trust by consumers in labels which would lead to a negative impact on the overall label valuation.

The findings of this study need to be further corroborated by additional research. First, it should be assessed whether this behavioural pattern holds for other products, as mentioned above; we believe some findings might be contingent on the product-claim choice. Prior research has shown that consumer preferences for claims varies from one product to another (Urala & Lähteenmäki 2004) and thus generalising the reported findings, specifically the negative valuation of nutrition claims by informed consumers, may be misleading. Second, our results are based on stated preferences which have always been subject to doubt due to lack of real budget constraints and compliance bias, thus, providing data on real choices would further confirm our findings.

Alternatives based on real behaviour, such as hedonic pricing, could be a way forward. However, when focused on products familiar to individuals, this bias is minimized, therefore our results should be considered an exploratory, although reliable, approach to this issue and provide an initial guidance in determining consumer heterogeneity in nutritional label valuation. Lastly, these results represent the behaviour of a representative sample of Spanish consumers, however these represent urban consumers and the extent to which these findings can be extended to rural consumers remains unclear.

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Table 1. Attributes and levels used in the experimental design.

Attribute	Levels
Price	0.20 € per pack 0.40 € per pack 0.60 € per pack 0.80 € per pack
Nutrition facts panel	Basic (energy, fat, protein, carbohydrates) Detailed (basic plus sugar, type of fat, cholesterol and sodium)
Nutrition Claim	None Low Fat content
Health claim	None Reduces the risk of cardiovascular diseases

Table 2. Sample characteristics (%, unless stated) and exogenous variables definition.

Variable definition	*Name (type)*	*Value*
Individual characteristics		
Gender		
Male	FEMALE (dummy)	28.0
Female		72.0
Age (Average from total sample)	AGE (continuous)	45.5 (14.62)
Education of respondent		
Elementary School	UNIVERSITY (dummy 1=university; 0 otherwise)	29.5
High School		34.0
University		36.6
Average household monthly Income[a]		
Below 600 Euro		2.1
Between 600 and 1,500 Euro		15.5
Between 1,501 and 2,500 Euro	INCOME (continuous)	32.5
Between 2,501 and 3,500 Euro		19.5
Between 3,501 and 4,500 Euro		10.1
More than 4,500 Euro		6.3
Household Size (Average from total sample)	HSIZE (continuous)	3.1 (1.21)
Household with children less than 6 years old (1=Yes)	CHILDREN (dummy)	19.0
Health habits and status		
Consumer suffers or has suffered health problems related to food intake (1=Yes)	HEALTH_PROB (dummy)	31.3
Consumer undertakes annual health checks ups (1=Yes)	CHECKUPS (dummy)	46.8
Trust in nutrition and health information sources		
Labels on food products (average from ten-point increasing scale)	TRUST_LABELS (continuous)	6.72 (1.94)
Public administration (average from ten-point increasing scale)	TRUST_ADMIN(continuous)	7.02 (2.01)
Nutrition and healthy eating knowledge		
Knowledge of healthy eating	KNOW_HEALTHY	[b]
Nutritional knowledge		
High (3)		4.38
Medium (2)	KNOW_NUTRI (ordered)	35.25
Low (1)		49.75
None (0)		10.63
Consumers concerns regarding, and importance assigned to, nutrition attributes		
Consumers importance attached, when shopping for food products, to the nutrition food attributes (ten-point increasing scale)	NUTRITION	[c]
Consumers' lifestyles		
Healthy lifestyles	LS_HEALTHY	[d]
Hedonistic lifestyles	LS_HEDONISTIC	[d]

For continuous variables standard deviations are presented in brackets.

[a] 14% of respondents did not provide information about level of income and have been assigned average income for further analysis.

[b] Results of factor analysis (see Table A.1 in Appendix)

[c] Results of factor analysis (see Table A.2 in Appendix)

[d] Results of factor analysis (see Table A.3 in Appendix)

Table 3. Statistics for determining the optimal number of consumer segments

Number of segments	*Number of parameters(p)*	*Log likelihood at convergence(LL)*	ρ^2	*AIC*[a]	$\bar{\rho}^{2}$ [b]	*AIC3*[c]	*BIC*[d]
1	8	- 2,278.20	0.35	4,572.40	0.35	4,580.40	2,320.57
2	24	- 2,145.26	0.39	4,338.52	0.38	4,362.52	2,180.10
3	40	- 2,086.64	0.40	4,253.27	0.40	4,293.27	2,144.70
4	56	- 2,075.09	0.40	4,262.18	0.39	4,318.18	2,156.37
5	72	- 2,014.23	0.42	4,172.46	0.41	4,244.46	2,118.74

Log likelihood evaluated at zero is -3,515.56

[a] AIC (Akaike Information Criterion) is calculated using $-2[LL-p]$

[b] $\bar{\rho}^{2}$ is calculated using $[1-AIC/2LL(0)]$

[c] AIC3 (Bozdogan Akaike Information Criterion) is calculated using $-2(LL+3P)$

[d] BIC (Bayesian Information Criterion) is calculated using $[-LL+(p/2)x\ln(N)]$

TABLE 4. Parameter values for Frankfurter sausage latent class choice model.

			Latent classes					
	One-segment model		*Health claim seekers*		*Facts seekers*		*Nutrition Claim seekers*	
Variable	*Coef.*	*t-ratio*	*Coef.*	*t-ratio*	*Coef.*	*t-ratio*	*Coef.*	*t-ratio*
ASC	3.573	24.374 ***	5.162	9.667 ***	2.600	8.996 ***	5.227	17.167 ***
PRICE	- 1.196	- 9.600 ***	- 2.102	- 7.191 ***	- 1.627	- 3.478 ***	- 1.010	- 7.951 ***
NPANEL	0.113	2.409 **	0.449	3.846 ***	0.699	4.547 ***	- 0.114	- 2.348 **
NCLAIM	0.307	6.771 ***	0.685	5.935 ***	- 3.386	- 9.385 ***	0.372	8.091 ***
HCLAIM	0.459	9.885 ***	1.633	12.676 ***	- 0.343	- 2.168 **	- 0.019	- 0.376
NPANEL&NCLAIM	0.105	2.439 **	0.317	3.100 ***	1.629	6.336 ***	- 0.056	- 1.282
NPANEL&HCLAIM	0.011	0.176	- 0.461	- 3.374 ***	- 1.261	- 5.608 ***	0.272	4.117 ***
NCLAIM&HCLAIM	-3.664	- 6.155 ***	- 1.044	- 7.515 ***	3.445	10.624 ***	- 0.207	- 3.511 ***
Class function			*Coef.*	*t-ratio*	*Coef.*	*t-ratio*		
CONSTANT			- 0.877	- 1.139	1.003	1.005		
KNOW_NUTRI			- 0.215	- 1.554	0.172	0.772		
KNOW_HEALTHY			0.924	5.056 ***	1.450	4.803 ***		
INCOME			0.267	1.795 *	- 0.974	- 3.141 ***		
UNIVERSITY			0.507	1.609	1.200	2.376 **		
TRUST_LABELS			0.067	0.898	- 0.477	- 4.283 ***		
HEALTH_PROB			- 0.462	- 1.502	0717	1.608 *		
CHILDREN			- 0.027	- 0.078	1.368	2.723 ***		
Class probability			0.41		0.07		0.52	
Number of observations	4800							

Note: *** (**) (*) denotes statistical significance at the 1 (5) (10) per cent significance levels

Table 5. WTP estimates for different labelling options (€ per pack of Frankfurt sausages).

	Main WTP			Total WTP		
	NPANEL	NCLAIM	HCLAIM	NPANEL & NCLAIM	NPANEL & HCLAIM	NCLAIM & HCLAIM
One-segment model	0.094	0.256	0.383	0.439	0.478	0.333
Health claim seekers	0.214	0.326	0.777	0.690	0.771	0.606
Facts seekers	0.430	-2.081	-0.211	-0.650	-0.556	-0.175
Nutrition Claim seekers	-0.113	0.368	-	0.255	0.156	0.163

Total WTP is calculated as follows:

WTP (NPANEL & NCLAIM) = $- (\beta_{NPANEL}+\beta_{NCLAIM}+\beta_{NPANEL\&NCLAIM})/ \beta_{PRICE}$
WTP (NPANEL & HCLAIM) = $- (\beta_{NPANEL}+\beta_{NHLAIM}+\beta_{NPANEL\&HCLAIM})/ \beta_{PRICE}$
WTP (NCLAIM&HCLAIM) = $- (\beta_{NCLAIM}+\beta_{HCLAIM}+\beta_{NCLAIM\&HCLAIM})/ \beta_{PRICE}$

Table 6. Results of analysis for class characterization.

	Mean value by class			Differences test statistic value		
Variable	*Health claim seekers*	*Facts seekers*	*Nutrition Claim seekers*	χ^2	F	Significance level
Class function						
KNOW_NUTRI		*see table 7*		14.36		0.0259
KNOW_HEALTHY	0.42 [a]	0.85 [b]	-0.44 [c]		113.77	< 0.0001
INCOME	2.65 [a]	1.87 [c]	2.36 [b]		18.19	< 0.0001
UNIVERSITY	0.44	0.35	0.30	15.73		0.0004
TRUST_LABELS	6.98 [a]	5.07 [b]	6.73 [a]		23.31	< 0.0001
HEALTH_PROB	0.22	0.54	0.35	27.03		< 0.0001
CHILDREN	0.21	0.41	0.20	12.06		0.0024
Other variables						
CHECKUPS	0.55	0.41	0.41	16.53		0.0003
FEMALE	0.75	0.52	0.72	12.24		0.0022
HSIZE	3.29 [a]	2.79 [b]	3.05 [b]		5.90	0.0029
AGE	44.11 [a]	46.41 [a]	46.57 [a]		2.70	0.0680
NUTRITION	0.12 [a]	0.12 [a,b]	-0.11 [b]		5.23	0.0055
TRUST_ADMIN	7.19 [a]	5.61 [b]	7.07 [a]		14.69	< 0.0001
LS_HEALTHY	0.15 [a]	0.54 [b]	-0.19 [c]		20.13	< 0.0001
LS_HEDONIC	0.18 [a]	-0.06 [a,b]	-0.14 [b]		10.04	< 0.0001

Different superscript letters indicate group means are different at the 5% level for continuous variables using Scheffe's test

Table 7. Descriptive statistics for the nutritional knowledge variable

	Percentage by class			
Nutritional knowledge	*Health claim seekers*	*Facts seekers*	*Nutrition Claim seekers*	Full sample
High (3)	20.5	37.0	20.5	21.6
Medium (2)	27.8	25.9	32.8	30.2
Low (1)	34.4	22.2	34.9	33.9
Null (0)	17.2	14.8	11.8	14.2

Table A.1. Factor loading for the knowledge variables with regards to relationship of eating habits with following a healthy diet.

Eating habit	Average rating	KNOW_HEALTHY
More fruits and vegetables	9.01	.7313
Less fat	8.21	.7741
Less salt	7.73	.6623
Less red meat	6.73	.6635
More fish	7.99	.7589
% of total variance		51.78
Eigenvalue		2.58
Cronbach's alpha		.766
Kaiser-Meyer-Olkin measure of sampling adequacy		.760

Table A.2. Factor loadings of importance given by consumers to different attributes when purchasing food products.

Attribute	*Average rating*	NUTRITION
Presence of nutritional information	6.53	**.8402**
Presence of list of ingredients	6.68	**.8179**
Organic production	5.40	**.7392**
Presence of list of additives and preservatives	6.54	**.6904**
Product under Protected Designation of Origin	5.25	**.5901**
% of total variance		40.180
Eigenvalue		2.810
Cronbach's alpha		.710
Kaiser-Meyer-Olkin measure of sampling adequacy		.748

Table A.3. Factor loadings of consumer lifestyles and habits

Statements	*Average agreement score*	LS_HEALTHY	LS_HEDONISTIC
I avoid fat in the food I eat	6.71	**.7464**	-.0175
I limit my salt intake	6.35	**.6687**	-.1855
I follow a balanced diet	6.60	**.6983**	-.1150
I avoid eating between meals	5.62	**.6799**	.1934
I frequently have meals outside my home	3.57	-.0466	**.7524**
I eat food that tastes good	7.19	-.0264	**.7377**
% of total variance		33.05	19.75
Eigenvalue		1.98	1.18
Cronbach's alpha		.430	
Kaiser-Meyer-Olkin measure of sampling adequacy		.687	