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Health information impact on the relative importance of beef attributes including its enrichment with polyunsaturated fatty acids (omega-3 and conjugated linoleic acid)

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ABSTRACT

This paper uses Choice Experiments (CE) to investigate Spanish consumers' preferences towards beef meat enriched with polyunsaturated fatty acids (omega-3 and conjugated linoleic acid). Data were gathered from self-completed questionnaires in a controlled environment with two different samples (320 and 322 consumers) differentiated by the information received. The surveys were carried out in three main Spanish cities (Barcelona, Zaragoza and Pamplona), representing the average consumer. A variation of the "Dual Response Choice Experiments" (DRCE) design was used due to its ability to emphasize the purchase context. Results showed that consumers who received information attach higher preference for enriched meat with polyunsaturated fatty acids. The utility associated with the higher content of fat increase for informed consumers, showing a substitute effect. Informed consumers are willing to accept meat with a higher amount of visible fat if it is enriched with beneficial fatty acids.

1. Introduction

Consumers' concerns about their well-being and product label information are gaining importance among the factors that currently affect the consumers' selection process (Bayarri, Carbonell, Barrios, & Costell, 2010). Thus, health concerns are becoming one of the most relevant predictors for food consumption (Lusk, Roosen, & Fox, 2003; Roininen, Lähteenmäki, & Tuorila, 1999). This tendency has given rise to a new range of products on the market that try to improve health by increasing well-being and reducing the risk of certain diseases (Bayarri et al., 2010). In this context, consumers are increasingly interested in such food products (Yoo, Saliba, MacDonald, Prenzler, & Ryan, 2013) as many awareness campaigns recommend the consumption of functional or health-enhanced foods. Thus, the fat content of the food has received higher attention over the last decades, and foods with reduced levels of total fat and increased levels of unsaturated fatty acids have gained market shares (Bower, Saadat, & Whitten, 2003; Sloan, 2008).

Beef was the third consumed meat in Spain during 2012 (6.38 kg/capita) after pork (10.68 kg/capita) and chicken (14.77 kg/capita), and its consumption has decreased by 18.41% since 2004 (MAGRAMA, 2013). Although beef consumption is affected by several exogenous factors such as its price, the price of substitute meat, the raw material cost and the occasion of consumption etc., it is also related to consumers' preferences in particular to their concerns for fat content (Realini et al., 2014) and health issues. Beef is associated by many consumers as rich in saturated lipids, which has favoured research on altering the fatty acid profile of animal tissues through dietary means, in order to match more closely current nutritional recommendations for a healthy diet. Omega-3 (n-3) fatty acids play a major role in human health and are involved in the development of brain and retinal tissues and in the progression and prevention of human diseases, including heart disease and some cancers (Connor, 2000; Simopoulos, 1999). Conjugated linoleic acid (CLA), naturally produced by ruminant animals, has the potential to reduce the risk of cancer, cardiovascular diseases, diabetes, and obesity, as well as to boost the immune system (see reviews of Khanal, 2004; O'Shea, Bassaganya-Riera, & Mohede, 2004; Pariza, 2004; Schmid, Collomb, Sieber, & Bee, 2006; Wahle, Heys, & Rotondo, 2004; Wang & Jones, 2004). Thus, animal feeding strategies have been successfully used to significantly increase poly-unsaturated fatty acids (Font i Furnols et al., 2009; Morales, Folch, Iraira, Teuber, & Realini, 2012; Realini et al., 2009; Wood, Enser, Richardson, & Whittington, 2008), and CLA in meat (Gillis et al., 2004; Schmid et al., 2006).

Consumer preferences do not only depend on their perception of the sensory characteristics of the products, but also on non-sensory variables (Jaeger, 2006; Varela, Ares, Giménez, & Gámbaro, 2010). Therefore, consumer meat preferences are usually analysed from two perspectives. The first one focuses on consumers' acceptance based on

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the use of intrinsic quality cues of the meat such as: cut, colour, and fat content (Koistinen et al., 2013) and the impact of different treatments (feed, rearing conditions, etc) on such quality (Acebrón & Dopico, 2000; Bernués, Olaizola, & Corcoran, 2003; Mesías, Escribano, De Ledesma, & Pulido, 2005; Napolitano, Caporale, Carlucci, & Monteleone, 2007; Napolitano et al., 2010; Olaizola Tolosana, Whebi, & Manrique Persiva, 2005; Xue, Mainville, You, & Nayga, 2010). The second one focuses on the extrinsic cues of the meat such as traceability (Loureiro & Umberger, 2007), production practices (Alfnes, 2004), origin (Brester, Marsh, & Atwood, 2004), safety (Aizaki, Sawada, Sato, & Kikkawa, 2011), format, promotion, price, brand, housing and credence cues that encompass the ethical and environmental aspects such as the animal welfare, natural, organic, extensive, certified humane and hormone free (Belcher, Germann, & Schmutz, 2007; Koistinen et al., 2013; Loureiro & Umberger, 2007; Pouta, Heikkilä, Forsman-Hugg, Isoniemi, & Mäkelä, 2010; Tonsor, Schroeder, Fox, & Biere, 2005; Verbeke, Pérez-Cueto, Barcellos, Krystallis, & Grunert, 2010, among others). In this context, the label information is also an important driven factor of consumer decisions (Roosen, Lusk, & Fox, 2003). Specifically, information about health properties of the products may affect consumer acceptance and purchase intent (Bower et al., 2003; Kähkönen & Tuorila, 1999; Lange, Martin, Chabanet, Combris, & Issanchou, 2002; Lusk et al., 2003; Napolitano et al., 2007; Napolitano et al., 2010; Stubenitsky, Aaron, Catt, & Mela, 1999; Varela et al., 2010).

In this paper we focused on analyzing the impact of information about health benefits of polyunsaturated fatty acids on the relative importance of different attributes, including meat enrichment with omega-3 and conjugated linoleic acid, in consumers' beef choices. To achieve this main objective, a structured questionnaire was implemented to a consumers' sample in Spain. The Choice Experiment (CE) was used, due to its suitability for the analysis of consumers' preferences towards "complex" goods (i.e., goods that include several descriptors or attributes) and the Dual Response Choice Experiment (DRCE) as experimental design.

2. Methods

2.1. The choice experiments

Within the range of techniques that analyse consumers' preferences, several alternatives are available (Kallas & Gil, 2012b). The Choice Experiments (CE) is one of the most relevant used method due to its capacity to analyse preferences for 'complex goods' as they are the food products. It belongs to the stated preference approach which is based on the creation of hypothetical markets for the analysed products. It involves the characterisation of the product through a series of descriptors (attributes and their levels) that can be combined following an experimental design to create different hypothetical scenarios of the product (alternatives). These scenarios differentiate the analysed product in one or more attribute levels. Respondents are faced with several of these scenarios (choice sets) and are asked to select their preferred product at different price levels, while implicitly making a trade-off between attributes.

Several designs are available to create choice sets. There are two main approaches. The first one is based on including into the choice sets a fixed alternative. This could be a status quo option (current product), an opt-out option (null-option or outside option), or neither of the hypothetical products presented (no-choice or no-purchase). By this approach respondents are not forced to choose a product from the choice sets. However, the second approach relies on forcing consumers to choose their preferred product by asking them to assume that the hypothetical products are the only available scenario.[1]

[1] Performing forced or non-forced choice has been addressed by several studies since decades. See among others Dhar and Simonson (2003) and Kallas et al. (2013) who have detailed the differences between the two approaches and their main implication on the results.

In this context, the Dual Response Choice Experiment design (DRCE) allows respondents to be asked in the same exercise to: a) select their preferred product in a forced-choice, and later, b) if they are willing to purchase the previous selected alternative (Fig. 1) in a non-forced scenario (Brazell et al., 2006; Kallas, Escobar, & Gil, 2013; Kallas & Gil, 2012a). According to this design, introducing a follow-up question after making a forced choice (step 2 in Fig. 1) is significant as it allows respondents to face a "purchase/no-purchase" decision response mode, which may better mimic the circumstances under which actual choices are made while replicating market situation (Ryan & Skatum, 2004). It also increases the reliability of results by better revealing more accurate consumers' preferences because respondents are approached twice for information about their preference with a conditional choice question and an unconditional purchase question (Kallas et al., 2013). Asking consumers if they are willing to purchase the product emphasises the purchasing context, leading respondents to focus more on their budget constraints by considering the price; while in the traditional single-stage CE, respondents can be driven by reason and logical arguments rather than by price considerations (Kallas & Gil, 2012a; McKenzie, 1993).

2.2. The modelling approach

Following the Random Utility Theory (Thurstone, 1927), subjects choose among alternatives according to a utility function with two components: a systematic (i.e. observable) component plus a random term (non-observable by the researcher):

$$U_{in} = V_{in}(X_i, S_n) + \varepsilon_{in} \tag{1}$$

where U_{in} is the utility provided by alternative i to subject n, V_{in} is the systematic component of the utility, X_i is the vector of attributes of alternative i, S_n is the vector of socio-economic characteristics of the respondent n and ε_{in} is the random term.

To predict the subjects' preferences for attributes and their levels, we need to define the "probability of choice" that an individual n chooses the alternative i rather than the alternative j (for any i and j within choice sets, (C)) which is equivalent to the probability that U_i is greater than U_j. Several probabilistic models are available to analyse choice stated data from CE. The Conditional Logit Model (CL) is the basic one where the probability that an individual n will choose alternative i (P_{in}) among other alternatives ($j = 1$ to J) of a set (C) is formulated as follows:

$$P_{in} = \frac{e^{\mu V_{in}}}{\sum_{j=1}^{j=J} e^{\mu V_{jn}}} \qquad \forall i \in C \tag{2}$$

where μ is a scale parameter. Within this model, the V_{in} must be defined. The most common assumption of this function is separable, additive and linear $\left(V_{in} = \beta_i + \sum_k \beta_k X_{ki}\right)$ where $k = 1 \ldots K$ represents the attributes which characterize alternative i, β_k is the parameter of the attribute k; X_{ki} is the value of attribute k in alternative i and β_i is the Alternative Specific Constant. However, the CL model requires the achievement of the Independence of Irrelevant Alternatives (IIA) property validated by the test of Hausman and McFadden (1984). However, this restrictive assumption is seldom respected in the stated choice data. Thus, several alternative models are able to relax this property. Among them we highlight the Error Component Model (EC), the Heteroscedastic Extreme Value model (HEV) and the Random Parameters Logit model (RPL).

Regardless of the different models used to analyse choice data for interpretation, the Marginal Rate of Substitution (MRS) between attributes can be calculated. From one side, since one of the attributes is expressed in monetary terms, it is possible to determine the implicit