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Title: Does taste matter? The importance of taste in the valuation of European Union mandatory nutritional and health claim labelling program in Spain

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Abstract

This research investigates the importance of taste in the valuation of European Union (EU) mandatory labelling program of nutritional claims (NCs) and health claims (HCs) on a selection of yogurts in Spain. Information regarding nutritional and health claims (NHCs) were collected from yogurt labels in the shelves of the main representative retail shops in Zaragoza - Spain. The final sample included 261 yogurts with one NC and 67 HCs on the front-of-pack (FOP) as defined by official European Council (EC) Regulation No 1924/2006 and No 432/2012. The experiment consisted of two treatments, each composed by three stages: (i) the sensorial analysis, where participants would taste/no-taste six different types of yogurts with NHCs, (ii) the evaluation of different products through a choice experiment method, and (iii) a brief questionnaire. The data were estimated using a generalized multinomial logit model (GMNL) that captures taste and scale heterogeneity in consumer preference. Results indicate that there were differences obtained in participants' utility when products were tasted with respect to the other treatment that did not include taste. In overall, our findings suggest that health claims outperform nutritional claims leading to higher utilities.

Key words: nutritional claims, health claims, safety choices, taste, utility.

Abbreviations: NC, nutritional claim; HC, health claim; NHC, nutritional and health claim; EU, European Union; FOP, front-of-pack; CE, choice experiment; MNL, multinomial logit model; RPL, random parameter logit model; GMNL, generalized multinomial logit model.

1. Introduction

Food quality, healthiness, taste and safety have been highly topical for the past 20 years in the public debate, the food policy, industry, and research. Generally, consumers today show higher interested in the healthiness of the food they eat than before. Increased awareness in health issues has led to an increase consumption of food products with nutritional and health claim (NHC) supplements. Many of these new food product developments with NHCs have been labelled as "functional foods" (Siró et al., 2008), but not all of them fulfill the requirements of carrying these labels. Hence, to guaranty safety and more informed food purchase, the European Food Safety Authority has provided a list of authorized NHC and the conditions for their use (Regulation (EC) No 1924/2006). In Spain the presence of food products with different types of nutritional labels reached 95% adherence, thus becoming one of the top countries in Europe (Prieto-Castillo et al., 2015). Evidence from previous studies show that the nutritional and health type of claims are seen as healthier alternatives that lead to healthier diets and consumers are willing to pay premium prices (Ballco and de-Magistris, 2018; Barreiro-Hurlé et al., 2010; de-Magistris et al., 2016; de-Magistris and Lopéz-Galán, 2016; Van Wezemael et al., 2014). Yet, even though consumers express positive evaluations for food product with NHC attributes, their purchase intentions do not always match their stated views. One main reason comes due to the fact that some food

products, although healthier compared to other foods without functional properties, do not meet the sensory expectations (i.e., taste) of consumers (Civille and Oftedal, 2012).

In this regard, this research investigates consumer preferences towards multiple NHCs and explores the importance of taste in the valuation of European Union (EU) mandatory labelling program on a selection of yogurts in Spain. To elicit consumer preferences for alternative NHCs, we employed a hypothetical choice experiment (CE). In a CE, respondents are asked to choose several times between alternative products described by different attributes with different levels (Louviere et al., 2002). This valuation method is preferred because it allows the estimation of several attributes simultaneously, and has a high degree of realism due to the similarity of the decisions taken when shopping products in the market.

A number of studies were conducted to measure the influence of sensory characteristics on consumers' acceptance[1]. In addition, many empirical studies were carried out to value attributes using CEs[2]. So far, very few studies[3] have combined both types of analysis, sensory and economic experiments but with different approaches and objectives to our paper. Results from these studies generally indicate that taste is important in determining choice behavior for a variety of food products and their attributes. However, to the best of our knowledge, no previous research has examined how taste influences final choice decisions on specific NHCs. The current study contributes to this research gap by examining the importance of taste in the valuation of multiple NHCs on yogurts.

2. Materials and Methods

Experimental design

The experiment was carried in Zaragoza-Spain, in the period of September - November 2016. A total of 218 participants were divided into two treatments (i.e. taste and no-taste), each composed by three stages: (i) the sensory analysis, where participants would taste/no-taste six different types of yogurts, (ii) the choice experiment, and (iii) lastly a brief questionnaire[4]. Information regarding NHCs was collected from the shelves of the main representative retail shops in the local food market of Zaragoza - Spain. Table 1 shows the attributes and attribute levels included in the CE.

Results indicated that yogurt was the product that contained the majority of NHCs, therefore, it was chosen for further analysis. The final sample included only yogurt packages that present one NC (261) and one HC (67) and were in accordance as those defined by the (EC) Regulation No 1924/2006. We selected a size of 500g (125x4) because it had the highest presence in the market and six levels of NCs and eight levels of HCs. A full-fat plain yogurt was selected as baseline for comparison.

Several studies indicate that HCs are not fully understood by the "average consumer". Hence, in addition to those that were present in the front-of-pack (FOP) of the chosen yogurts in the local market (e.g., health claims number 2, 5 and 7 as reported in table1) we used five additional HCs regulated by the Regulation (EC) No 1924/2006 (e.g., health claims number 1, 3, 4, 6 and 8 as reported in table 1) that are easier to understand according to a focus group of fifteen "average consumers". In our study we replicated Carlsson et al. (2007) by using a CE without the price attribute. As in Carlsson et al. (2007), we told participants that all alternatives cost the same. We used a full crossing of the experimental factors, which leaded to 44 choice sets of NHCs to be evaluated. To reduce this number to a more

[1] (Erraach et al., 2014; Sáenz-Navajas et al., 2013; Tonsor, 2011).

[2] (Erraach et al., 2014; Vlontzos and Duquenne, 2014; Yangui et al., 2014).

[3] (Banović et al., 2009; Combris et al., 2009; Kallas et al., 2016; Mueller Loose et al., 2010; Napolitano et al., 2010; Zhang and Vickers, 2014).

[4] Results from the questionnaire are not displayed in this study.

effective manageable size, we divided them into 4 blocks of 11 choice sets. Each choice set included three alternatives: two designed alternatives consisting of different products and a no-buy option (i.e., A, B or no-buy).

Table 1: Levels of nutritional claims used

N°	NC levels	Presence (%)	HC levels	Presence (%)
1°	Free fat	42.78	1. Reducing consumption of saturated fat contributes to the maintenance of normal blood cholesterol levels (A)*	-
2°	Source of calcium	21.25	2. Calcium is necessary for maintaining bones under normal conditions	2.17
			3. Calcium contributes to normal muscle function (A)	-
3°	Plain - Full fat (Baseline)	12.26	-	-
4°	Low sugar	11.99	4. Consumption of food containing sweeteners instead of sugar induces a lower blood glucose (A)	-
5°	Source of vitamin B6	10.63	5. With vitamin B6 that helps your defenses and reduces fatigue	10.33
			6. Vitamin B6 contributes to the normal functioning of nervous system (A)	-
6°	High in fiber	1.09	7. Fiber contributes to an acceleration of intestinal transit	3.80
			8. Fiber contributes to an increase in fecal bulk (A)	-

*Defines that a HC has not yet being introduced to the local market - absent (A).

Experimental procedures

Upon their arrival, participants received information consisting of the main purpose of the experiment, were familiarized with the NHC official definitions and signed an inform consent of participation. An ID number was assigned to each respondent to guaranty anonymity. In the first stage respondents taste six different yogurts, each with the corresponding nutrition content table information and evaluate taste on a 9 point hedonic scale (9= I like it very much, 1= I dislike it very much) and whether they would purchase it on a 5 point hedonic scale (1= yes, 5= no). The second stage carried out the CE with only the extrinsic yogurt information. Yogurts differed in two attributes (NCs and HCs). Participants had to choose the yogurt they mostly prefer among three product options: two designed alternatives (A and B) or the no-buy option. Finally respondents reported their demographic information (gender, age, income, education).

Model specification

CE is consistent with the random utility theory and the Lancaster theory (Lancaster, 1966) of consumer demand. Accordingly, the utility that individual n derives from alternative j at choice occasion t can be represented as follows:

$$U_{njt} = V_{njt} + \varepsilon_{njt} \quad (1)$$

where V_{nj} is the representative portion of the utility that depends on the attributes presented in alternative *j*, and ε_{nj} is the stochastic (unobserved and treated as random) element, which is assumed to be *iid* extreme type 1 distributed. We first use the multinomial logit model (MNL) as the baseline standard regression specification. In order to relax the assumption of homogeneous consumer preferences, and account for heterogeneous preferences in taste, we used a

random parameter logit model (RPL). In the RPL model, the utility that individual n derives from alternative j at choice occasion t can be represented as follows:

$$U_{njt} = Nobuy + \beta_1 ncfat_{njt} + \beta_2 hcfat_{njt} + \beta_3 ncsug_{njt} + \beta_4 hcsug_{njt} + \beta_5 ncfib_{njt} + \beta_6 hcpfib_{njt} + \beta_7 hcafib_{njt} + \beta_8 ncvit_{njt} + \beta_9 hcpvit_{njt} + \beta_9 hcavit_{njt} + \beta_{10} nccal_{njt} + \beta_{11} hcpcal_{njt} + \beta_{12} hcacal_{njt} + \varepsilon_{njt} \quad (2)$$

$Nobuy$ is the alternative-specific constant representing the no-buy option. The other thirteen attributes enter the model as dummy variables, where *"plain"* yogurt represents the baseline. Louviere et al. (2002) argued that *scale heterogeneity* is a major source of taste heterogeneity in choice models; therefore, the RPL model is mis-specified as it ignores this scale heterogeneity. The argument led Fiebig et al. (2010) to develop the generalized multinomial mix logit (GMNL) model, which nests the RPL model and the MNL model and takes into consideration the scale heterogeneity. where $\sigma i = \exp\left(-\frac{\tau^2}{2} + \tau vi\right)$, $vi \sim N[0,1]$, γ_i is a parameter between 0 and 1 that indicates how the variance of residual taste heterogeneity varies with scale in a model; σ is the scale of error term, which captures scale heterogeneity, assuming that σ is heterogeneous in the population; and η captures the residual taste heterogeneity. The parameter γ_i is only presented in the GMNL model. If $\gamma \rightarrow 1$ the standard deviation of η is independent of the scaling of β. This model is called GMNL-I. On the other hand, when $\gamma \rightarrow 0$, the standard deviation of η_n is proportional to σ_n; the next equation is called GMNL-II. Hence, in our case, equation (2) is re-specified to include the scale heterogeneity and the GMNL-II model is defined as follows:

$$U_{njt} OptOut + [\sigma_n (\beta_1 ncfat_{njt} + \eta_n)] + [\sigma_n (\beta_2 hcfat_{njt} + \eta_n)] + [\sigma_n (\beta_3 ncsug_{njt} + \eta_n)] + [\sigma_n (\beta_4 hcsug_{njt} + \eta_n)] + [\sigma_n (\beta_5 ncfib_{njt} + \eta_n)] + [\sigma_n (\beta_6 hcpfib_{njt} + \eta_n)] + [\sigma_n (\beta_7 hcafib_{njt} + \eta_n)] + [\sigma_n (\beta_8 ncvit_{njt} + \eta_n)] + [\sigma_n (\beta_9 hcpvit_{njt} + \eta_n)] + [\sigma_n (\beta_{10} nccal_{njt} + \eta_n)] + [\sigma_n (\beta_{11} hcpcal_{njt} + \eta_n)] + [\sigma_n (\beta_{12} hcacal_{njt} + \eta_n)] + \varepsilon_{njt} \quad (3)$$

Finally, because σ_n represents the scale of the idiosyncratic error, it should be positive. Thus, σ_n is assumed to be log-normal with mean 1 and standard deviation τ which is the key parameter that captures the scale heterogeneity. First we used a pooled data approach[5] to check for differences across the taste and no-taste treatments and then we use a split data approach. Hence, we estimated the two models separately for each treatment: taste and no-taste.

3. Results

The GMNL estimates were conducted in Nlogit 5. Table 2 reports the coefficients from the two treatments. Outcomes indicate that the coefficient of the no-buy alternative is negative and statistically significant, indicating that participants' utility is maximized by choosing one of the proposed NHCs alternatives with respect to the no-buy alternative. The coefficients of most attributes are positive and statistically significant at 5% and 1% significance level indicating that the utility of participants increases when these NHCs are included on yogurts as compared with the unlabeled yogurt. In addition, most of the standard deviations of the random parameters are statistically significant, indicating the presence of unobserved heterogeneity in taste preferences across participants. Most notably, our results also indicate that participants' utility changes across the two treatments (taste and no-taste). When they taste the products the highest utility is captured when the *HC_fat* label is present on the FOP followed by the *Hcp_vit* and *HCP_cal*. On the other hand, when participants do not taste the product they attach a higher utility when yogurts bare the *HC_fat* followed by

[5] We also estimated the model using a pooled data approach to investigate whether differences across the taste and no-taste treatments is due to difference in preferences for the NHCs, in scale, or both. The scale effect was not statistically significant indicating there is no difference in scale across the two treatments: taste and no-taste. Results from the pooled model are not included in the final results and are available upon request.

HCP_cal and both *HCP_vit* and *HCA_vit*. In overall in both treatments participants attached a lower utility when the nutritional claims are not accompanied by health claims on the FOP (or are even not significant e.g., *NC_fat, NC_fib* and *HCA_Fib*).

Table 2 – Parameter estimates from a GMNL model across treatments (n=218)

Generalized Multinomial Logit model		
Attributes	Taste (n=115)	No-Taste (n=103)
	β (z)	β (z)
No-buy	-0.19**(-2.22)	-0.21** (-2.17)
NC[1]_fat	**0.28 (1.25)**	**0.14 (0.59)**
St.dev.	2.64*** (9.87)	0.05 (0.41)
HC[2]_fat	**2.65***(11.87)**	**3.37***(8.89)**
St.dev.	1.60***(12.41)	3.02***(11.45)
NC_sugar	**-0.42* (-1.94)**	**-0.85***(-3.29)**
St.dev.	1.23***(4.18)	1.62*** (7.33)
HC_sugar	**1.43***(5.99)**	**2.09***(8.26)**
St.dev.	2.75***(12.25)	2.69*** (13.66)
NC_fiber	**0.04 (0.28)**	**0.50***(3.40)**
St.dev.	2.32***(15.42)	1.63*** (13.02)
HCP[3]_fiber	**1.44***(11.84)**	**1.89***(12.70)**
St.dev.	0.05***(0.46)	0.57*** (4.90)
HCA[4]_fiber	**0.36***(2.86)**	**0.01 (0.04)**
St.dev.	0.46*** (3.91)	0.22* (1.90)
NC_vitamin	**-0.53***(-3.57)**	**-0.66***(-4.18)**
St.dev.	2.02*** (17.49)	1.53*** (11.21)
HCP_vitamin	**2.24***(14.09)**	**2.44***(12.58)**
St.dev.	1.27*** (10.07)	0.54*** (3.11)
HCA_vitamin	**1.48***(9.63)**	**2.11***(13.51)**
St.dev.	1.56*** (10.48)	0.92*** (4.72)
NC_calcium	**-0.69*** (-4.85)**	**-0.72***(-4.77)**
St.dev.	2.74*** (12.30)	1.74*** (13.25)
HCP_calcium	**2.05***(15.40)**	**2.52***(15.91)**
St.dev.	0.08 (0.68)	0.11 (0.67)
HCA_calcium	**1.54***(13.03)**	**1.87***(13.51)**
St.dev.	0.21** (2.33)	0.12* (1.06)
τ – scale	0.21*** (4.02)	0.39*** (9.15)
σ	0.99*** (4.83)	0.98*** (2.60)
N	5060	4529
Log-lik.	-4598.00	-2870.52
AIC	1.823	1280

Notes: *,** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. [1]NC means nutritional claim. [2]HC means health claim. [3]HCP means health claims present in the local market. [4]HCA means health claims absent from the local market.

4. Discussions and conclusions

This article analyzed consumer preferences towards multiple NHCs and explored the importance of taste in the valuation of EU mandatory labelling program on a selection of yogurts in Spain.

Results indicated that HCs outperformed NCs leading to higher utilities. Since the presence of HCs in the local market is very low (2%) compared to NCs (28%), this potential demand would be an opportunity that producers, processors and retailers could be interested to use when developing marketing strategies. Results demonstrated that there were significant preferences in utility across treatments (taste and no-taste) suggesting retailers that they can increase store sales by highlighting nutritional and health claims and provide sensory samples of the product. To this end, managers

and marketers can employ different marketing strategies depending on which chrematistics they want to point out. Our study provides an avenue for government regulation of products with nutritional and health claims in particular for healthy products, such as yogurt. Results revealed that many health claims that are not yet present in the local market and are considered by the "average consumer" as easier to understand, were found to have significant utility in consumer preferences. Therefore, policy makers and public bodies should take into consideration the expansion of health claims in the Spanish market and include those claims that are mostly preferred by consumers (e.g., *Hc_sug* and *Hc_fat*).

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