Attention and Choice: Use of Eye-tracking in choice behavior research for nutritional claims. An empirical evidence of yogurts in Spain

Petjon Ballço[1,2], Tiziana de Magistris[1,2]

[1] Unidad de Economía Agroalimentaria, Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA), Avda. Montañana 930, 50059 Zaragoza, Spain.

[2] Instituto Agroalimentario de Aragón-IA2 (CITA-Universidad de Zaragoza), Zaragoza, Spain.

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Abstract

Nutritional claims (NCs) are tools that help consumers make healthier choices. The European Commission recommends these tools as an effective way to fight obesity in a bio-economic context. The aim of this study is to explore the importance that Spanish consumers attach to NCs in yoghurts combining visual attention and choice decision. A total number of 100 consumers stratified by age, gender and educational level completed the final experiment in Zaragoza-Spain. An eye-tracking technique was integrated in the choice decision to measure visual attention paid to different alternatives of yogurts with NCs. Preference ranking results indicated that consumers gave more attention on fat-free, low in sugar and yogurts with source of vitamin B6. Actual choices had also a direct relation between the attention (total fixation time) spent. These findings suggest that total fixation duration can be interpreted as a direct proxy for actual choices.

Keywords: Nutritional claims (NC), eye-tracking, choice, yoghurt, consumers

1. Introduction

In the last decade, the increase of unnecessary high-energy and high-fat food intake are seen as two of the main factors that have stimulated malnutrition and high levels of obesity worldwide (54% overweight and 17% obese in Spain in 2012) (Bravo, 2016; WHO, 2015). Increase in obesity has resulted to chronic health problems, diabetes mellitus type 2, cardiovascular diseases, iron-deficiency anemia, lack of zinc, and deficiency of vitamins and minerals (Bravo, 2016; Ng et al., 2014). Hence, both the Food and Agriculture Organization (FAO) and the United Nations (UN) have made calls for a transition to healthier and more sustainable food system (Dötsch-Klerk et al., 2015; Garnett et al., 2015; FAO, 2010; UNEP, 2010). European Food Safety Authority has also designed strategies to fight obesity in sustainable ways presenting new foods and food ingredients (Regulation (CE) Nº 258/97) and nutritional and health claim (Regulation (CE) Nº 1924/2006) regulation strategies to help citizens make better food choices in terms of healthier and more sustainable purchase decisions. Empirical evidence revealed that consumer demand determines both the healthiness of a diet through nutritional intake and the sustainability of products and production systems (Verain et al., 2016; Heller et al., 2013; Grunert, 2011). Therefore, consumer food choices are crucial in shifting diets towards healthier and more sustainable consumption patterns. In this paper we focused specially on this latter aspect and explore consumer food choices for healthier and more sustainable diets in the purchase decision through the combination of visual attention (eye-tracking) and choice to buy yoghurts with nutritional claims in Spain. More specifically, we explored the importance that 100 Spanish consumers attached to nutritional claims in yoghurts and investigated how this related the visual attention paid during the choice decision. The study was carried out in the city of Zaragoza-Spain, in the period of September - November 2016. Visual attention was measured through an eye tracking technology in terms of gaze and fixation time (milliseconds), while the choice decisions were measured using the choice experiment (CE) method. We decided to use CE because it is similar to the real market process where the seller adds prices and consumers make the choice on which product to buy.

Previous research indicates that the eye-tracking technique is a useful tool for studying consumer preferences and behaviors. The eye-tracking technique permits the observation and measures the eye movement when consumers receive a visual stimulus or look at a product. The eye-tracking device usually tracks parameters using an infrared light reflection from the center of the pupil and measures the distance and angle of that reflection in terms of gazing and fixations (Duchowski,

2007). In the food sector, the eye-tracking technique has been mainly used in the marketing research. Eye-tracking can determine how packaging and attributes (layout, nutritional label, color etc.) attract attention by recording the areas that consumers pay attention (Rebollar et al., 2015; Siegrist et al., 2015). Others have evaluated the healthiness, the willingness-to-purchase, taste included and studied the goal oriented of food products (Ares et al., 2013; Graham and Jeffery, 2012; Bialkova and van Trijp, 2011; van Herpen and Trijp, 2011). Eye-tracking is also applied in consumers´ perception of sensory properties such as color, perceived tasting (Jantathai et al., 2013), quality perceptions of healthiness (Mittereer et al., 2014), factors that influence choice and eating motivation (e.g., positive-negative mood) (Werthmann et al., 2013), rational and intuitive thinking styles on food choice (Ares et al., 2014) and also understand how psychological illness (anorexia nervosa, eating disorder and/or Body Mass Index (BMI) status) influence consumer food choices and habits (Horndasch et al., 2012; Graham et al., 2011).

In general, there are several studies that combine attention and choice in nutritional information of food products in terms of monochrome and color coded Guideline Daily Amount (GDA) labels, (Vu et al., 2016; Bialkova et al., 2014; Bialkova and van Trijp 2011) but to the best of our knowledge, there is a scant literature available on combining attention and choice to study specific nutritional claim preferences. Similar study has been carried out by van Loo et al., (2015), which explores the importance that consumers attach to sustainability attributes of coffee and investigates how this relates to the visual attention paid to these attributes during the choice decision and to willingness-to-pay (WTP).

2. Materials and methods

This study was carried out into two steps. The first step contains an analysis of the European Union regulation of nutritional claims and the selection of the product from a detailed research of the local market on food products that contain nutritional claims (see Section 2.1 for further details). The second step presents a combination of the eye-tracking technique and the actual choices of nutritional claims in yoghurts (see Section 2.2 - 2.3 – 2.4 and 2.5 for further details).

2.1 First step: the prevalence of NC in Spanish market

The selection of the nutritional claims to be used in this study is in accordance to official definitions of NCs from European Union Regulations. More specifically, to distinguish similar NCs present in the local food market from the official ones available, we considered Regulation (EC) No 1924/2006, which states that a nutrition claim is "*…any statement that suggests or implies that a food has specific beneficial nutritional properties…*" (Unión Europea, 2006). This definition distinguishes two types of nutritional claims. The first group refers the content of nutrients or substances, for example "Source of vitamin B6" while the second group compares the content in terms of reducing or increasing a nutrient or substance of a product with respect to its conventional version. An example may be: "High content of calcium". To determine the presence of NCs we created a database that collects information regarding food products available in the Spanish market between July and September 2015. The sample included a total of 4568 food products marketed in 3 hypermarkets and supermarkets present in the national territory. To guarantee the representativeness

of the sample[1], the data were collected in the online stores and were validated with visits to the physical stores of Carrefour, Mercadona and Dia food distribution chains, which account for 40% of the sector's market share (Kantar Worldpanel, 2017). The food product sample includes pre-packaged foods and excludes fresh foods, infant food, alcoholic beverages, food supplements, processed products sold in bulk or fresh packaged products. The pre-packaged foods sold included in the database were selected according to their importance in the shopping basket of Spanish families. According to the MAPAMA, (2014) Consumer Observatory in Spain, 89% of the per capita consumption of packaged food was made in liquid milk, processed meat, yogurts, cheeses, industrial bread and biscuits. Observations indicated that yoghurt is the food product that mostly carries nutritional claims, as result it was selected to be further studied. More specifically, out of 509 yoghurts in total, 367 of them contained one or two nutritional claims. Out of 367 yogurts with NCs only 261 were taken into consideration for further analysis because the packaging contained only one NC that also corresponded to the official ones defined by the Regulation (EC) No 1924/2006. The type of NCs chosen to be included in the study were based on the group of nutrients present in yogurts (Fat, sugar, fiber, vitamin and minerals) and the sub-groups with the highest presence in the local market (Table 1). Since this is a part of a larger project, another condition of selecting the NCs was to fulfill the EU legislation requirement of going together with the corresponding health claim in the same package (e.g., fiber-source yogurts can be present only as a nutritional claim information in the package of a yogurt and not be together with a health claim because it does cannot meet the nutritional conditions of the (EC) No 1924/2006 regulation). All yoghurts are natural with no fruits and flavors except the one with high-in-fiber. We decided to include the high-in-fiber yogurt due to the high demand and the large variety of cereal fiber-source yogurts in the local market. In order to meet the condition of going together with a health claim we included for further analysis the high-in-fiber claim. Summarizing the findings from the local food market and the information extracted from the EU regulations, we decided to include one unlabeled yoghurt as the product of reference and five yoghurts with NCs for further analysis (Table 1).

Table 1: Levels of nutritional claims used

Nº	Natural Yoghurt with NC	Presence of NC
1º	Unlabeled (no NC – Reference)	12.26%
2º	Fat-free	42.78%
3º	Low sugars	11.99%
4º	High fiber	1.09%
5º	Source of vitamin B6	10.63%
6º	Source of calcium	21.25%

[1] It is worth to mention that while in countries like United Kingdom a handful of large operators control more than 80% of the market, in Spain the local chains and small distribution companies still distribute about 45% of the pie.

2.2 Second step: Eye-tracking and choice experiment design

2.2.1 eye-tracking technique

The second step of our study is the combination of the eye-tracking and actual choice of nutritional claims in yogurts, selected in the step 1. The eye-tracking technique is increasingly being applied in the fields of consumer behavior and marketing (Muñoz-Leiva et al., 2016; Scott et al., 2016; Lewis et al., 2016; Wedel and Pieters, 2008, 2007). In the food sector, is mainly being applied in researches of evaluating the healthiness of a product, the willingness to purchase and study the goal oriented attention (Vu et al., 2016; Bialkova and van Trijp, 2011). The eye-tracking device usually tracks parameters using an infrared light reflection from the center of the pupil and measures the distance and angle of that reflection in terms of gazing and fixations (Duchowski, 2007). Gazing is defined as eye movements, while fixations are defined as periods that the eye is relatively still. Fixations are characterized by frequencies and duration (Rayner, 2009; Duchowski, 2007).

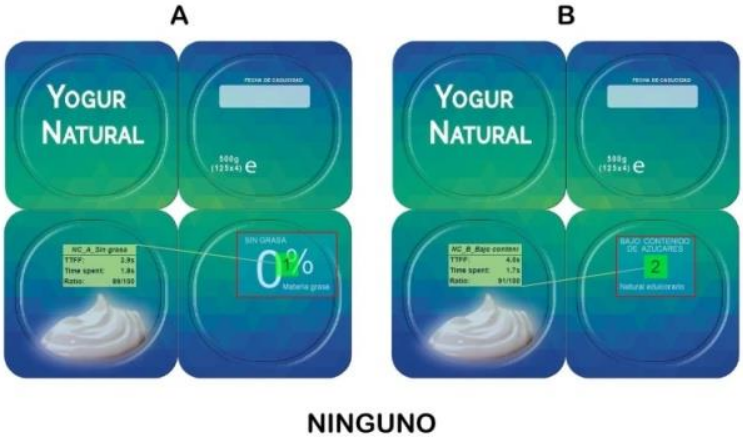

Figure 1: An example of the stimuli

Gazing time spent is defined as rapid eye movements inside an AOI based on raw data. Gazing time spent show towards which elements of a stimulus the eyes are looking at, depending on the eye-tracker speed data collection rate (e.g., 60 Hz, data will end up with 60 individual gaze points per second). If a series of gaze points happens to be close in time and range, the resulting gaze cluster denotes a *fixation*, a period in which our eyes are locked toward a specific object. Typically, the fixation duration is 100 – 300 milliseconds. The eye movements between fixations are generally referred to as *saccades* (Rayner, 2009; Duchowski, 2007; Salvucci and Goldberg, 2000). *Fixations* are characterized by frequencies and the duration which the eye is still Bialkova at al., 2011). Depending on the scene complexity, the marketing literature reports that typical mean fixation durations range from 200 to 400ms (Wedel and Pieters, 2007; Salvucci and Goldberg, 2000). It is worth mentioning that for the analysis of eye gaze data we have to define the minimum time that constitutes a fixation also called as *threshold value*. We use the threshold value of 100ms following the suggestion of the eye-tracking company provider. *Time-to-first-fixation (TTFF)* indicates the amount of time it takes a respondent to look at an AOI from stimulus onset. AOIs which are seen at first are typically visually more appealing and are therefore of more interest (Salvucci and Goldberg, 2000). A recent study investigating the influence of the first fixation on consumer choice (van der Laan et al., 2015) found that the location of the first fixation had no positive correlation with consumers' choice. Therefore, the authors stated that catching the first gaze of the consumer might be unnecessary. *Fixation time spent* is the sum of all respondent´s fixation durations and the

fixation count is the number of fixations frequency recorded inside an AOI. The fixation count provides a reliable measure of participants´ attention for that particular AOI (Figure 1).

Although the benefits of eye-tracking has evolved at more accurate estimates of label use in comparison to the self-report traditional research on nutrition label methodology, it should be mentioned, of course, that eye-tracking also has limitations. One limitation is that eye-tracking methodology may lack realism for study participants due to the fact that these studies may occur in a laboratory with participants seated at a computer where an eye-tracker monitors their gaze. In addition, knowing that they eyes are being monitored, could influence one to behave differently from how they might behave at a normal purchasing processed or when not being monitored. Another limitation is that eye-tracking does not tell us about the underlying reasons of eye movements. In other words, we can see what participants are looking at but not why they are looking at this nutritional label. There might be different reasons when a participant does not look at a specific nutritional label. One may be that an individual is uninterested in nutritional information. On the other hand, if this nutritional label is previously viewed or consumed, further examination might feel unnecessary. To overcome certain limitations in the interpretation of data accuracy when using eye-tracking, it is useful to interview participants after the eye-tracking task and ask what they were thinking during the task. A suggestion of Graham et al., (2012), also applied in our research is to go back at the participants eye-tracking recordings and simulate a think-aloud task. Last, it should be mentioned that using an eye-tracking technology is expensive and time-consuming.

2.2.2 Stimuli and design

All yoghurts were natural with no fruits and no flavors, except the one with fiber, which contained several types of cereals (oat, barley, wheat and wheat bran). In terms of packaging size, we decided to use the 500g (125x4) because it was the size with the highest presence in the market. For the analysis of the eye movement data, we defined a set of AOI to capture the eye fixations on each of the nutritional claim information (unlabeled, fat-free, low sugars, high fiber, source of vitamin B6, source of calcium) (Figure 2). It is worth mentioning that since the “unlabeled” yoghurt had no nutritional claim information on its Front-Of-Pack (FOP), we decided to select the right-down part of the FOP, which is the area where the yoghurt information should be (in our case), in order to measure the time in gazing and fixation and compare it with the other yoghurts. Except the unlabeled yoghurt, which the size of AOI was a bit larger, the other nutritional FOPs had very similar AOI size (width – height).

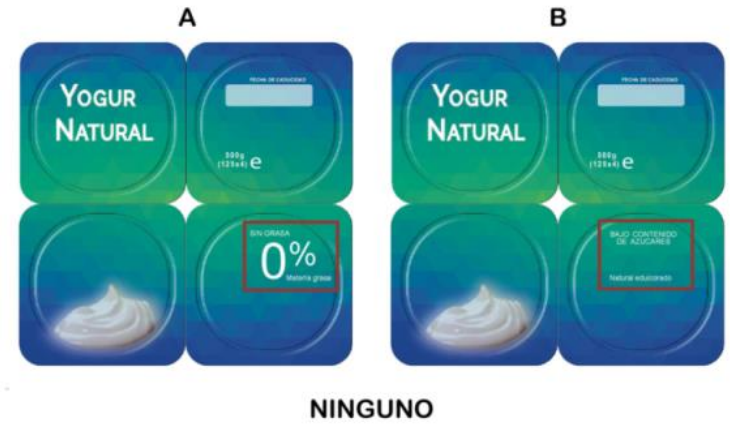

Figure 2: An example of the Areas of interest, AOIs

For each of these AOIs (across the 15 two-alternative choice-sets) we calculated the mean of gazing time spent, fixation time spent and fixations count. The Student's T-test is used to compare the differences between the two variables and finally a ranking of preference of variables is given in terms of gazing time spent and fixation time spent. The yoghurt´s front-of-packaging (FOP) was designed by a professional agency. In order to avoid brand preference and color that would relate to different types of yogurt, (e.g., dark green color might be related to the Danone – Activia bifidus type of yogurt) we created a totally new packaging with no brand and no color similarities with any other yoghurt present in the local market. To make the FOP as real as possible we added the expiring date empty spaced and an image of natural yoghurt to each FOP. Prices were not included in this experiment because the main objective was to concentrate mainly to the nutritional information of the product without any restriction. On a computer screen, participants were presented with the FOP of two different yoghurts (Figure 2). The full crossing of the experimental factors led to 15 two-alternative choice sets to be evaluated. Each product appeared 5 times in the combination of choice sets, and participants had 10 seconds to choose. After 10 seconds, participants were asked to choose the mostly preferred yoghurt with nutritional claim in the form of 3 alternatives (A, B or none of them). The randomization order of the 15 two-product combinations was done through a mathematical combinatorics calculator. The calculator estimates the number of ways to choose a sample of *r* elements from a set of *n* distinct objects where order does not matter and replacements are not allowed. More specifically:

$$C\ (n,r) = \frac{n!}{(r!(n-r)!)} \quad (1)$$

Where,

C - are the combinations, *n* - the number of objects, *r* - the sample. The appearance of the 15 two-product combinations was than randomized for every 5 participants to avoid ordering effects.

2.2.3 Choice experiment

One of most popular and recent methods to value food product attributes is the State choice experiment where consumers are familiar with the markets where the seller adds prices and they make the choice on which product to buy. Then the choice experiment (CEs) method, where people make repeated choices between hypothetical bundles of goods, may be a more promising validity of stated preference method (List et al., 2006). Even if the main shortcoming stated of the CE is the hypothetical bias, choice experiments are increasingly used to value food products attributes because it presents several advantages. It allows the estimation of several attributes simultaneously and it is consistent with Lancaster's consumer theory (Lancaster, 1966) and McFadden's random utility theory (McFadden, 1974). As mentioned above, another advantage of this valuation method comes from the way of obtaining information from consumers. The respondents face different choice tasks, and their decisions are similar to those they have to take when shopping. Two papers compared both valuation methods (Gracia et al., 2011; Lusk and Shogren, 2006) providing some insights on the differences on valuation and the advantage and the disadvantage of both. However, any of them could definitely determine which of these valuations more closely represents consumers' valuation. At this point, researchers may have to select the one that better resembles market behavior or corresponds better with the context in which participants will expose their true preferences. Therefore, the present study uses a choice experiment to investigate consumers´ preferences for yogurt with nutritional claims.

2.2.3.1 Choice modeling specification

Choice is a stated method widely used to analyze consumer preferences for products with several attributes. Respondents are asked to choose several alternative products with different attributes and different levels (Gracia et al., 2013; Louviere et al., 2002). This method is based on Lancaster theory (Lancaster, 1966) which assumes that consumers follow a utility-maximizing behavior.

In the empirical application and for the selected yogurts, the utility function specified for individual *n*, alternative *j* at choice situation *t*, is defined as follows:

$$U_{njt}=\text{no-choice}+\beta_1 \text{Nograsa}_{njt}+\beta_2 \text{Lazuc}_{njt}+ \beta_3 \text{ Fibra}+ \beta_4 \text{VitB6}+ \beta_5 \text{Calcio} +\varepsilon_{njt} \quad (2)$$

Where *n* is the number of respondents, *j* which represents the available choices of choice sets (alternative A, B and the no-choice) and t the number of choice sets. The no-choice is the alternative-specific constant, coded as a dummy variable equal to 1 for not being chosen and 0 otherwise. It is expected that the constant no-choice gets a negative value and significant, indicating that consumers obtain a higher level of utility when they select one of the two alternatives (A and B) than the no-choice option. The other five variables (Nograsa, Lazuc, Fibra, VitB6 and Calcio) are defined as dummy variables where "unlabeled" yogurt represents the product of reference. Lastly, the εnjt is an observed random term that is distributed following an extreme value type (Gumbel) distribution over alternatives and it is independent of β and the attributes.

Traditionally, multinomial logit (MNL) models assume that consumer preferences are homogeneous in terms of utility. However, in order to relax this assumption and allow that consumer preferences are heterogeneous, we used a Random Parameter Logit. In order to take into account that the designed alternatives have a higher utility variance than the no-choice alternative which is missing in the utility of the no-choice option and is captured by a shared error component, we decided to estimate an Error Component RPL (ECRPL). In addition, to test whether utility parameters are correlated, we also estimated an Error Component RPL (ECRPL) with correlated errors model assuming that the correlations structure of β_n follow a multivariate normal distribution. For the estimation of the RPL and ECRPL models, we used 200 Halton draws rather than pseudo-random draws since the former provides a more accurate simulations (Train, 2003; Train, 1999) and assumed that the coefficients for the five dummy variables (Nograsa, Lazuc, Fibra, VitB6 and Calcio) are random following a normal distribution.

Comparing the results of the three models the ECRPL with correlated errors was considered to have the best fit based on the Likelihood Ratio tests and on the fact that homogenous preferences (MNL model) and uncorrelated utility parameters were rejected because the standard deviations for the estimate parameters were statistically significant different from zero. Results for this model were used for further discussion.

2.4 Participants

A total number of 116 consumers participated in the experiment and 100 were considered for the final sample (Table 2). The experiment was conducted in the period of September - November 2016 in Zaragoza - Spain which is a town widely used by food marketers and consulting companies since the socio-demographics are representative of the Spanish Census of Population (Appendix, Table 1). Participants were randomly recruited by a subcontracted professional market research agency using a stratified sampling procedure, by gender, age and education level. The requirements for recruitment were to be at least occasional food buyers in the household, households who consumed yoghurts at least occasionally and participants older than 18 years. Participants were instructed to

refrain from eating for 2 hours before the session to ensure that food was a relevant stimulus. All participants had normal or corrected-to-normal vision and full color vision.

Table 2: Socio-demographic characteristics.

	Sample n=100 (%)	Population (%)
Gender		
Male	42.87	(50.00)
Female	57.13	(50.00)
Age		
Average	45.18	44.20
18–34 years	23.09	(22.24)
35–44 years	19.12	(19.55)
45–54 years	17.07	(18.28)
≥ 55 years	40.72	(39.93)
Level of education		
Primary	17.32	(24.88)
Secondary	45.38	(47.64)
Superior	37.03	(27.48)

Values in parenthesis correspond to the Spanish population. Data obtained from the Register (INE) on January 1, 2015 (www.ine.es) and the OECD study "Education at a Glance: OECD Indicators" (2014).

Participants were 57% females and 43% males and ranged in age from 18 to 57 with an average age of 45.18 years. The majority of participants belongs to the secondary level of education (45.38) followed by a superior educational level (37.03). A gift equivalent to approximately 7€ was given for their participation in the study.

2.5 Procedure

Upon their arrival, participants received information consisting of the main purpose of the experiment and signed an inform consent of participation. An ID number was assigned to each respondent to guaranty anonymity. Then, a general overview of the whole working session and the approximate duration was provided. The combination images were presented one by one in full color on a 24” computer screen with a 1920x1080 pixel resolution. Eye positions were sampled at 50 Hz, with remote eye-tracking device (Tobii X2-30 Eye tracker) integrated under the computer screen of which the stimuli were displayed. Before the display, a 9 point calibration procedure was run. The distance between the eye-tracking device and the participants’ eyes was approximately 58-60 cm. Before start recording the eyes movement participants were familiarized with an example of two-alternative choice task and then they were asked to choose.

3. Results

3.1 Visual attention

The summary results of mean preference scores from the different yoghurts in terms of gazing time spent, fixation time spent and fixation count are shown in table 3.

Table 3: Summary of statistical tests – mean preference scores and T-test

	Mean scores		
	Time spent-G (ms)	Time spent-F (ms)	Fixations Count
Unlabeled	**509.43**	**279.09**	**1.29**
Free-fat	2807.27	1736.20	7.05
Difference	-2297.84	-1457.11	-5.76
T-test	-27.70	-20.60	-23.50
Low in sugar	2694.17	1715.46	6.97
Difference	-2184.75	-1436.37	-5.68
T-test	-26.96	-20.53	-23.25
High in fiber	1313.58	876.39	3.53
Difference	-804.16	-597.30	-2.24
T-test	-16.17	-14.33	-14.70
Source of vitamin B6	2919.29	1683.61	7.50
Difference	-2409.86	-1404.52	-6.21
T-test	-30.20	-21.92	-25.45
Source of calcium	2671.51	1562.40	6.76
Difference	-2162.10	-1283.31	-5.47
T-test	-26.97	-19.25	-22.65

Note: all variable are statistically significant at 1 % ***

As can be noted, participants spent the highest amount of gazing time (2919 ms) in the source of vitamin B6 yoghurt followed by the fat-free (2807 ms) and low in sugar (2694 ms), evaluated as the third mostly viewed. The rest of yoghurts with source of calcium, high in fiber and the unlabeled were the least attended. However, gazing time spent determines the total time of participant´s eyes looking at an AOI which is like reading a book and your mind might be elsewhere. Fixation time and fixation count is what really determines that the AOI is really seen. At this point, fixation time and fixations counts are used to find the most and least preferred yoghurt with nutritional claim.

When comparing the result of gaze time spent and fixation time spent we observe several differences (Table 4). More specifically, consumers spent most time fixation in the Fat-free yoghurt (1736 ms) followed by the low in sugar yoghurt (1715 ms) and the source of vitamin B6 (1684 ms) ranged in the third place. The yoghurt with source of vitamin B6 ranged as the first mostly preferred in terms of gazing, but when compared to fixation time it was ranged as third. This means that the attraction in the first case was a simple look of the FOP of this yoghurt without really paying attention to its information. The fixations count are also reflected at the heat map choice sets depicting the most preferred average area of all participants (Figure 3). For each time the eye points to a pixel of the image, the number for that pixel goes up by 1.

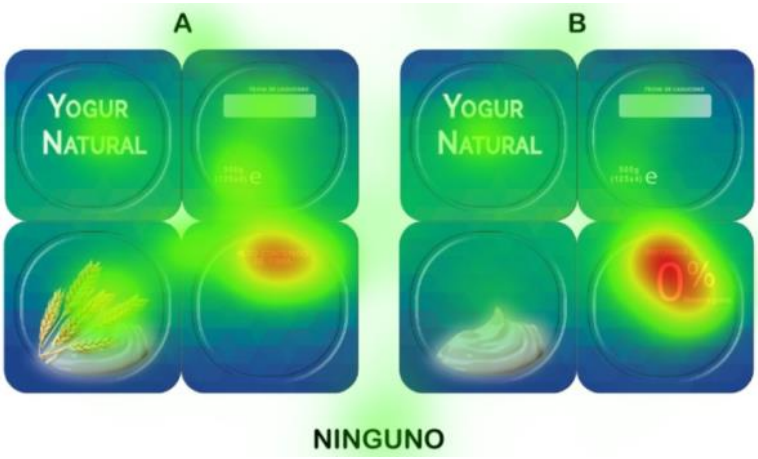

Figure 3: Example of average heat map depicting most preferred area for all participants

As the number of fixations increase, so does the numbers ultimately displayed as a "hotter" color on the heat map. Except the "unlabeled" and the "high in fiber" yoghurts that received the lowest number of fixations (1) and (4) respectively, the rest of yoghurts with NCs received an average fixation count of (7).

Table 4: Ranking mean scores based on gazing time spent and fixation time spent on each AOI.

Ranking	Ranking mean scores			
	Yoghurts	Time spent-G (ms)	Yoghurts	Time spent-F (ms)
1º	Source of vitamin B6	2919.29	Fat-free	1736.20
2º	Fat-free	2807.27	Low in sugar	1715.46
3º	Low in sugar	2694.17	Source of vitamin B6	1683.61
4º	Source of calcium	2671.51	Source of calcium	1562.40
5º	High in fiber	1313.58	High in fiber	876.39
6º	Unlabeled	509.43	Unlabeled	279.09

3.2 Choice Analysis

This section describes the results of actual choice preferences for yogurts. Comparing the results of the three models, the ECRPL with correlated errors attained the best fit looking at the log-likelihood and the pseudo R2. In addition, homogenous preferences (multinomial logit model), non-extra error component and uncorrelated taste parameters were rejected because the standard deviations for the estimate parameters hypothesis, the estimated of the standard deviation of the latent random effect and the Cholesky matrix were statistically significant different from zero. Results for this model are presented in table 5 and used for further discussion.

Outcomes from table 5 show that the constant no-choice is negative and significant indicating that consumers gain higher utility from choosing any alternative than the no-choice option. Three yogurts with nutritional claims (fat-free, source of vitamin B6 and low in sugar) are positive and statistically significant at 1% and 5% significance level. Results indicated that participants receive higher utility from yoghurts that have the free-fat, source of vitamin B6 and low in sugar nutritional claim in comparison to the unlabeled yoghurt.

Table 5: Estimated parameters of the ECRPL correlated model

	Coefficients	T-ratio (z)
Parameters		
No-choice	-1.75***	9.36
Free-fat	1.96***	7.00
Source of vitamin B6	0.63***	2.59
Low in sugar	0.61**	2.02
Source of calcium	0.35	1.09
High in fiber	-0.07	-0.24
Standard Deviation		
NsFree-fat	4.15***	10.16
NsLow in sugar	4.52***	12.98
NsSource of vitamin B6	4.35***	14.38
NsSource of calcium	4.54***	16.30
NsHigh in Fiber	4.35***	9.36
Diagonal Cholesky		
Free-fat	4.15***	10.16
Low in sugar	3.53***	11.37
Source of vitamin B6	4.24***	9.15
Source of calcium	3.15***	11.11
High in Fiber	2.54***	8.11
$\sigma 2$	1.62***	8.04
Log L	-1016.31	
$\chi 2$	1263.21***	
Number of observations	4500	

Note: Significance at ***1% **5% *10%

The standard deviations of the three dummy variables (Fat-free, source of vitamin B6 and low in sugar) are statistically significant indicating that consumer preferences for these three attributes are indeed heterogeneous. In addition, consumers are indifferent for the two other yoghurts with nutritional claim (source of calcium and high in fiber).

4. Discussion and conclusions

The food sustainable topic has received increased attention from governments, nongovernment organizations and food industry (Dötsch-Klerk et al., 2015; Garnett et al., 2015; FAO, 2010; UNEP, 2010). A challenging question for European Food Safety Authority is how to drive consumers´ attention towards healthy options and thus encourage healthier and sustainable eating. Although recent studies have mainly addressed consumers´ ability to understand different formats of nutritional labels (e.g., monochromes or colored (GDA) Guideline Daily Amount, choices logo etc.), an issue that needs further elaboration is to combine the attention of simple-to-understand nutritional claims set by EU Regulations in the real-world shopping situation. The current study addresses this issue, not only in terms of attention-getting properties but also combining attention with actual choices of yoghurts in Spain. Results show that the tested nutritional claims are in a direct relation of attention captured when compared to the actual choices. In particular, the fat-free yoghurt followed by low in sugar and source of vitamin B6 yoghurts had the highest attention (measured in terms fixation count and fixation time) compared to the other three yoghurts of high in fiber, source of calcium and the unlabeled. With respect to actual choices, results from the ECRPL correlated model demonstrated that consumers obtain a higher utility from fat-free, source of

vitamin B6 and low in sugar yoghurts in comparison to the unlabeled one. On the other hand, participants were indifferent on high in fiber and source of calcium yoghurt. Even though, not in the same exact ranking of preference, our findings indicated that there is a direct relation between the attention (fixation time and fixation count) spent and the actual choices.

Our findings are in line with the previous studies of van der Laan et al., (2015) analyzing the role of the first fixation and total fixation duration in consumer choice on two products in Netherland. Results suggested that both, the most wanted and the least wanted decision type the total fixation duration was longest for the product of choice. In other words, the chosen alternative was the eventually most preferred one in the most wanted decision type but the eventually least preferred one in the least wanted decision type. Bialkova et al., (2014) also confirms our findings exploring whether and how attention to nutrition information mediates consumers´ choice on yogurts with different nutrient profile information, brand, and flavor, selecting the healthiest or the mostly preferred product. Results suggested that attention mediates in terms of fixation counts and fixation time the effect of nutrition labels on choice. On a different food product, Van Loo, et al., (2015) provided also similar insights suggesting that visual attention plays a role in explaining choice behavior for coffee in Arkansas – USA.
The general results of this study demonstrated that fixation counts and fixation time for the coffee sustainability labels were an indication of the relevance of these attributes to consumers when making their food choices. Lastly, Armel et al., (2008) predict the possibility to affect real binary choices by manipulating the relative amount of visual attention that decision-makers pay to the two alternatives on three behavioral experiments (appetitive food items, aversive items and art posters). Results confirmed that increase in relative visual attention increases the probability of a preferred good being chosen and vice versa for a product less preferred. Our findings emphasizes the importance of eye-tracking in the research of nutritional claims and suggests that total fixation duration can be interpreted as a direct proxy for actual choices of healthier and more sustainable eating.

Although, the eye-tracking methodology has evolved at more accurate estimates in comparison to other traditional research methodologies on nutritional labels, there also certain limitations that should be mentioned. One of the main limitations of the present study is that consumers evaluated nutritional claims on a computer screen. Knowing that they eyes are being monitored due to the calibration process, might have influenced one to behave differently from how they might behave at a normal purchasing processed or when not being monitored. The hypothetical nature of the choice experiment may also be considered as an artificial setting since no real purchase decision was involved. Further research is needed to accurately study consumers´ preferences of nutritional claims in real or 3D food packages using a mobile eye-tracking system. Moreover, even though the objective of the study was to exclude prices and focus on nutritional claims, it would be interesting to include price information and provide consumers´ willingness-to-pay.

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6. Appendix

Table 1 – Population by sex and age in Spain and town.

	Sex		Age					
Total	Female	Male	0-14	15-34	35-54	55-64	65-84	85 and more
Spain	51	49	15.06	22.59	32.20	11.76	15.60	2.79
Zaragoza	50	50	14.06	21.13	31.53	12.24	17.24	3.80

Source: Spanish Census of Population, 2015 www.ine.es

[a] in percentages.