Displaying ingredients on healthy snack packaging: a study on visual attention, choice and purchase intention.

Running title: Ingredient display effects on healthy snack packaging

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ABSTRACT

The key packaging element in healthy snacks is the ingredient. This research highlights the use of eye tracking by companies to achieve greater effectiveness on the consumer's attention. Three healthy snacks were presented to analyse whether there are differences in their attention, choice, and purchase intention according to the type of ingredient. An eye tracking device and a questionnaire were applied and the results showed that the central area of the packaging of healthy snacks in which the ingredients are shown attracts more attention. Positive relationships between the choice of a snack and the intention to purchase it, and between the total fixation duration and the choice of a product were found. Food products with more hedonic components (flavour, e.g., chocolate) were much more visually attractive and captured more attention. At the same time, those products with less desirable or palatable ingredients were chosen less.

Practical applications: This research provides insights into how packaging design influences consumer perceptions of healthy snacks. Food packaging plays a crucial role in capturing consumer attention and communicating information that affects their purchasing decisions. In this context, understanding how consumers direct their attention and what information they consider when evaluating products is essential for professionals in fields such as food science, marketing and graphic design, where the use of eye-tracking devices is key. Furthermore, resistance to less desirable or unfamiliar products hinders purchase intent, suggesting the need to improve their appeal and communicate their health benefits. This study confirms that, when designing the packaging of healthy snacks, it is necessary to focus more on the central part of the packaging, which should show the composition and its appearance with a real image of it.

Keywords: packaging; food; sensory science; eye tracking; neuromarketing; attention; consumer neuroscience; consumer behaviour.

1. INTRODUCTION

There are now a large number of functional foods, i.e. foods with nutritional and health-promoting properties, which have a positive effect on health and go beyond basic nutrition. These are, for example, low-fat products, cholesterol-lowering foods and foods that provide vitamins, minerals or fibre (Küster and Vila, 2017). Although the use of these products is widespread, there are still consumers who do not know how to categorise them, thus causing them to pay little attention to them at the point of sale and not to buy them (Granqvist and Ritvala, 2016). According to Auttarapong (2012), the appearance of the packaging should generate positive reactions, thoughts or sensations among consumers, which attract them to the product.

Marketers do not have an in-depth understanding of how and what information consumers use to judge whether products are more or less healthy (Karnal *et al.*, 2016). In the few seconds that consumers spend making a choice, the design of the packaging could, therefore, help to attract their attention and influence their purchase decisions. Some authors claim that product evaluation is directly influenced by packaging elements, such as nutrition labels (Ballco *et al.*, 2020, van Herpen *et al.*, 2013; Vyth *et al.*, 2010) or health labels (Vidal *et al*., 2013). Although there is extensive research on the relevance of food labelling for consumer choice and wellbeing (Cowburn and Stockley, 2005; Drichoutis *et al*., 2006; Theben *et al.*, 2019; Küster-Boluda and Vila, 2020), the evidence of their impact on health assessments, food choice (Aschemann-Witzel *et al.*, 2013) or consumption behaviour (Roberto *et al.*, 2012) is still scarce.

Many packaging design parameters should be considered in order to ensure that the packaging conveys the most effective message, captures the consumer's attention in the shop and achieves its full strength as a tool by which to improve the product experience (Simmonds and Spence, 2017). The visual design of a package can alter consumers' perceptions and preferences (Creusen and Schoormans, 2005), which is why packaging design elements such as size, shape, logo, colour and font are recognised as effective tools by which to differentiate products in a saturated market (Chandon, 2013). Understanding these parameters with respect to packaging design is crucial if designers and marketers seek to satisfy consumers by giving them what they really want.

Therefore, this research analyses how product packaging can affect consumers' attention, choice and purchase intention. We enhance the knowledge regarding labelling and

packaging as strategic marketing tools, especially in a competitive and mature food industry.

In the lack of eye tracking methodology, studies that analyse the influence of product packaging on the consumer use self-reports (Olavarrieta *et al.,* 2012), think-aloud protocols (Barnett *et al.,* 2011), conjoint analysis-based methodologies (Gadioli *et al.,* 2013; Koutsimanis *et al.,* 2012) or verification questionnaires (Ng *et al.,* 2013). The source of the problems inherent in conducting these studies lies mainly in the fact that they rely on the different personal skills of individuals (such as speaking) and the lack of objectivity in the evaluations as a result of interview pressure, which means that some participants may perceive the study as an exam (Rebollar *et al.,* 2015). Thus, some authors have concluded that other types of studies are needed to help better understand consumer response to packaging design elements (Silayoi and Speece, 2004). Rebollar *et al.* (2015) contribute with their study to this direction by using eye-tracking technology to analyse how potential buyers view chocolate snack packaging when impulse buying. Therefore, eye-tracking is able to collect objective data on participants' behaviour quickly and less invasively when presented with a visual stimulus (Graham *et al.,* 2012), which facilitates the investigation of unconscious mechanisms when viewing product packaging (Rebollar *et al.*, 2015).

The present study aims to fill another gap in academic research as previous studies lack information on the possible influence of different types of food on visual attention (Hummel *et al*., 2017). This issue is particularly relevant in the context of food advertising (Velazquez and Pasch, 2014). The technique employed to obtain this information is eye tracking, a tool from the field of neuroscience. The eye-tracking technology considers the physiological movements of the human eye, analysing the psychological consequences of these movements and provides precise recommendations on how to improve packaging design based on the data obtained from the analysis (Franken, 2020).

Eye tracking is used in many research studies that hypothesize that longer eye fixations are associated with higher levels of attention and interest (resulting in a positive reaction, liking and assimilation) (Matukin *et al*., 2016). In addition to explicit measures, such as self-reported appetite ratings, the analysis of implicit measures, such as reaction time or eye movements, can provide a better understanding of the process of food selection and evaluation by consumers (Wang *et al*., 2018; Morquecho-Campos *et al*., 2022).

2. LITERATURE REVIEW

2.1. PACKAGING AND PERCEPTION OF HEALTHINESS

The packaging of a product is a key factor that can determine its success in the marketplace (Rebollar *et al*., 2015). A specifically interesting research topic is how the appearance of packaging can influence perceptions of healthiness. A package is made up of different types of elements that are useful for capturing and maintaining the attention of customers (Otterbring *et al.*, 2013). Unique and attractive packaging is a necessity and design nowadays offers new creative opportunities to achieve greater visibility through material, shape, colour or graphics (Rundh, 2016). However, studies examining how the more implicit visual cues on packaging impact on the extent to which shoppers perceive a flavour sample to be healthy are limited (Van Rompay *et al.*, 2016). Of these, the majority have used eye tracking to understand how attracting consumers' visual attention influences their choice of healthy food (e.g., Ballco *et al*., 2020; Morquecho-Campos *et al.*, 2022; Oliveira *et al*., 2016; Spielvogel *et al*., 2018).

The health food industry is often confronted with a problem on the consumer side, which is that health food is seen as unpleasant, and that it is necessary to sacrifice sensory pleasure in order to achieve a healthy diet (Tuorila and Cardello, 2002; Baixauli *et al.*, 2008). Healthy food choices are often considered to conflict with food pleasure. Previous studies have shown that consumers may perceive food products as more or less tasty, filling and satisfying depending on how they are described (Chirico-Scheele *et al.*, 2021). When conducting studies on consumer response to packaging design elements, problems arise related to the different personal skills of individuals (judgment or oral expression) and to the lack of objectivity in the evaluations due to the pressure of the interviews (Rebollar et al., 2015). Because of these problems, some authors conclude that other types of studies are needed to help better understand consumer response (Silayoi and Speece, 2007) such as the use of eye-tracking (Rebollar *et al.*, 2015).

When making their daily food choices, consumers obtain product cues from the information and designs they find on the package, which generate sensory and hedonic expectations about the product (Moskowitz *et al.*, 2009; Oliveira *et al.*, 2016), and balance sensory and non-sensory factors (Jaeger, 2006). Thus, packaging or labelling generates expectations related to health benefits, and these may influence hedonic and sensory perception (Varela *et al.*, 2010). Simply looking at the packaging, therefore, allows

consumers to imagine how the product will taste and how much they will like it. In fact, in the review by Motoki *et al.* (2021), it is highlighted that previous research has found that unhealthy foods tend to attract more attention through eye tracking device. Furthermore, consumers are more willing to buy products that taste better (Ballco *et al.*, 2020).

The selection of comprehensive and effective front-of-pack nutrition information has a major impact on the consumer's decision–making process (Mauri *et al.,* 2021). Brands typically use health and nutrition labelling as a means to position their products as healthy products (Lähteenmäki, 2013). Along with these health claims, the presence of visual elements such as fruit or even elements referring to nature can increase the perceived healthiness of the food (Arrúa *et al.,* 2017). Previous research (e.g. Oliveira *et al.,* 2016) linked consumer associations to health and justified this influence mainly by graphic design rather than product description. If health claims are too long, they are likely to reduce consumer interest and attention. Therefore, presenting less information helps ensure that it is fully processed. Centurión *et al.* (2019) supported the potential of nutrition warnings to influence consumers' perception of healthfulness. Simple graphic designs (signs and colours) are more effective than numerical information in influencing consumer perception and behavior (Peters *et al.,* 2007). If nutrition warnings are placed at the top of labels, they attract more attention (Cabrera *et al.,* 2017).

The purpose of this labelling is, therefore, to guide the consumer towards healthy products by showing information concerning the content of the food (Cowburn and Stocklet, 2005). Both increased trust in information and the perceived healthiness and visual appearance of the product will consequently have a decisive influence on the consumer's attitude towards products classified as healthy. If consumers have a positive attitude towards these products, then their intention to buy them will increase (Küster and Vila, 2017). Karnal *et al.* (2016) state that the effect of design features on health perception is more pronounced for those individuals who focus on health promotion and less for those who are not concerned about this aspect of their diet.

2.2. FOOD IMAGES ON PRODUCT PACKAGING

Products come wrapped in their own distinctive packaging. This packaging not only protects the product, but also affects consumers' preference for it and their beliefs about its sensory attributes. Thus, the inclusion of an image of the product in the packaging makes it easier for consumers to imagine what the product would be like in terms of taste, smell, and appearance, among others. In other words, packaging activates sensory associations in the consumer's mind, which impacts their perception and behavior towards the product (Krishna *et al.*, 2017).

Although research on the use of food images on product packaging is still relatively limited, there are already some important lessons to be learned, such as the fact that product images on packaging can be an effective means of communicating with the consumer (Simmonds and Spence, 2017). The food industry employs a broad range of verbal (e.g., nutrition and health claims) and nonverbal (e.g., colours, shapes, images and symbols) signals to convey the healthfulness of products and influence consumer decisions (Skubisz, 2017). According to Huang *et al.* (2022), food-packaging images are one of the most important extrinsic elements for consumers to evaluate food products before purchasing them. Studies underline the importance of nutrition claims and references to naturalness in the perception of healthiness in products with an unfavorable nutritional composition (Arrúa *et al*., 2017; Sütterlin and Siegrist, 2015).

It is essential to facilitate the consumers' purchasing process by providing them with information on the packaging design that may be of interest to them. This is important because 70% of the customers' purchasing decisions are made at the point of sale (Ståhlberg and Maila, 2012). In this same line of research, Elliott (2008) showed that the image of food on packaging causes the consumer to feel that the product tastes better than those products whose packaging has no images. Consequently, it is important to know which elements on packaging attract attention and whether they are a key element in consumer purchasing decisions (Steenhuis *et al.*, 2004).

The product information obtained from the imagery on the packaging, therefore, makes it possible to make a direct comparison of products, in addition to attracting the consumer's attention (Venter *et al.*, 2011). The findings of the aforementioned authors highlight that the image of the product on the package acts as a key source of information

for consumers, enabling them to identify product attributes through a reliable source and compare different products in the category.

Previous studies suggest that consumers evaluate food and drink through simulations of consumption and reward, especially if they are appealing (Papies *et al.*, 2020). Similarly, Passamonti *et al.* (2009) found that food sensitivity was also particularly potent when viewing images of appetising versus tasteless foods and concluded that this type of viewing can trigger the desire to eat. With regard to visual appearance, authors such as Wadhera and Capaldi-Phillips (2014) demonstrated that visual exposure was very important in increasing the acceptance of a new product.

Turnwald and Crum (2019) have shown that the use of food labels and packaging that emphasise sensory and hedonic characteristics rather than healthy characteristics increase choices and preferences for vegetable-based dishes because such labels trigger rewarding consumption simulations. Comparable results have been found in other studies, such as those of Grabenhorst *et al.* (2008) and Woods *et al.* (2011).

Although consumers constantly see and read information on product packaging, it is relevant to know which specific information captures their attention the most, especially during their first contact with a new food product. Indeed, given the short time consumers spend deciding which product to buy, they cannot process all the information available on the package. Therefore, attention is a crucial element in the consumer's decision-making process (Ares *et al.*, 2013). Specifically, most of the previous studies found that have used this device in the field of sensory and consumer science have focused on measuring fixations (e.g., Ares *et al.*, 2013; Hummel *et al.*, 2017; Morquecho-Campos *et al.*, 2022; Motoki *et al.*, 2018; Oliveira *et al.*, 2016; Rebollar *et al.*, 2015; Spielvogel *et al.*, 2018). During fixation, the eye remains relatively motionless, usually for a period ranging from 200 to 500 milliseconds. During this interval, consumers are considered processing information about the stimulus they are viewing, which may be related to subsequent processes such as preference formation or choice (Motoki *et al.*, 2021).

The objective of this research was to assess whether the presence of a more palatable food (such as chocolate) on packaging attracts more attention and stimulates a greater purchase intention than less palatable foods (quinoa and seaweed).

Therefore, the following research questions were formulated:

RQ1. Is there a relationship between attentional measures and the choice and intention to purchase healthy snacks?

RQ2. Does the type of ingredients influence the attentional measures of healthy snacks?

RQ3. Does the type of ingredients influence the choice and purchase intention of healthy snacks?

RQ4. Do healthy consumption habits influence attentional measures, along with healthy snack choice and purchase intention?

3. MATERIALS AND METHOD

3.1. Participants

The study sample consisted of forty-seven people (55% male, 45% female), with an age range of 18 to 48 (M = 20,72; SD = 4,51). Consumers were enrolled by means of a call for applications via email. Inclusion criteria were having normal or corrected eyesight. In addition to having no visual impairments or colour blindness, in order to be able to carry out the task. Participation was voluntary and informed consent was obtained from all participants. Furthermore, the study has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans.

3.2. Materials

In this research, healthy snacks were chosen because of the positive healthy image they currently have, just as other studies have chosen cereal bars because of their growing popularity and healthy image (Centurión *et al.,* 2019). The experiment analysed the packaging of three varieties of the Gullón® (Vitalday) snack brand products (oatmeal and seaweed versus oatmeal, rice and dark chocolate versus oatmeal, quinoa and flax). It is a type of food or fashionable product for which differentiation is important, given the wide variety of brands and flavour options

All three currently exist on the market and are shown in Figure 1. In the three images below, the brand, ingredients and content areas have been highlighted. The marked areas corresponding to the brand include the name of the company and of the product, the

ingredients consider the description and the picture, and finally the weight of the product and content were the element considered below. In order to determine these areas of interest, statistical analyses were taken into account, which indeed confirmed that in these areas there were no differences between them and they could be used as a common element for all three varieties.

Figure 1. Stimuli provided (A: seaweed; B: chocolate; C: Quinoa) and delimited areas of interest (brand, ingredients, and content).

3.3. Apparatus

A personal computer with a Windows 10 operating system was used. The snacks were presented full screen on a 21-inch monitor, viewed from a distance of 60 cm and with a resolution of 1920 × 1080 pixels. Eye movements were recorded using an infrared eye tracking device from The Eye Tribe company, with a sampling rate of 60 Hz. The software used to process the data obtained from eye tracking was Ogama software (Version 5.1 (30.03.2021)). This non-invasive, computer-connected device relies on reflexes that allow the eyes to be tracked more accurately and provides some freedom as regards head movement (Hahn *et al.*, 2016) and is considered a direct measure of visual attention (Rebollar *et al.*, 2015). Therefore, it measures the movements made by the subject's eyes and their position, thus allowing the chosen object to be processed, leaving the rest aside (Casado-Aranda *et al.*, 2020). It is the so-called selective eye focus that creates a path towards a stimulus, in this case the product (Hübner *et al.*, 2010), providing information about behaviour and cognitive process (Meißner and Oll, 2019). This is where eye tracking becomes important as the most appropriate tool by which to measure this eye focus (Bridger and Noble, 2015). This tool could help to increase their interest in the product and increase purchase intent (Oliveira *et al.*, 2016).

3.4. Instruments

3.4.1. Eye tracking measures

Attentional measures were obtained using an eye tracking device. The following were obtained for each snack: 1) *time to first fixation* (TFF), which indicated the total amount of time that elapsed between the presentation of the stimulus and the first fixation on it; 2) *total fixation duration* (TFD), which reflected the total amount of time spent examining the area of interest; and 3) *fixation count* (FC), which was employed to quantify the

number of times the area of interest was looked at. The first two metrics were, therefore, measured in milliseconds, while the third provided a count.

3.4.2. Questionnaire

Self-reported measures were collected by asking the participants to answer two statements measured with a 5-point Likert scale, where 1 = *strongly disagree* and 5 = *strongly agree*. The first item referred to snack choice, "I would choose these snacks in order to take care of myself," while the second referred to snack purchase intention, "I would buy these snacks." The participants were also asked to respond to the following question: "Do you usually consume healthy products", with a Yes/No response.

3.5. Experimental design

An experimental design was employed in which the healthy consumption habit was a within-subject factor (the consumption or otherwise of healthy snacks) and the type of ingredient (seaweed, chocolate and quinoa) was a between-subject factor. The healthy consumption habit was obtained by means of the item "I usually consume healthy snacks", whose response was dichotomous (Yes/No). The dependent variables were time to first fixation, total fixation duration, fixation count, choice, and purchase intention.

3.6. Procedure

The experimental procedure was carried out in May 2022. It consisted of two parts, which were presented to the participants in a random order. After signing informed consent forms, each participant was seated 65 cm from the computer screen and the experiment began. In one part, a questionnaire was employed in order to obtain socio-demographic information, the participants' healthy eating habits and their choices and preferences as regards the snacks presented. In the other part, their visual attention towards each of the snacks presented was registered. The order in which the stimuli were presented was random in both phases, the experiment was carried out individually, and it lasted an average of 15 minutes.

When applying the eye tracking device, the participants were requested to sit comfortably in front of a monitor and to move as little as possible. The calibration of the eye tracking then began in order to ensure that the apparatus used correctly registered eye movement. This was done by asking each participant to look at a total of seven points until they disappeared, after which they were shown the stimuli in a random order (see Figure 2).

These stimuli filled the whole screen, and each one was shown for 5 seconds following the guidelines of previous studies (Reale and Flint, 2016; García-Madariaga *et al.*, 2019; García-Madariaga *et al.*, 2020). There was a gap of 0.5 seconds between each stimulus during which an image of a 'fixation' cross appeared on the screen. The presentation of the stimuli lasted for 1 minute and 10 seconds.

Figure 2. Example of procedure employed to register eye movement.

3.7. Data analysis

All analyses were carried out using the SPSS 25 statistical package, and a multistep procedure was followed. It was first necessary to verify that there were no statistically significant differences in the brand and content areas according to snack type, which was done using repeated measure analyses of variance (ANOVAs). Pearson's bivariate correlations were then used to calculate the correlations between the self-reported and attentional variables, after which five statistical tests were performed using repeated measure ANOVAs. This, therefore, allowed the verification of possible statistically significant differences among snack packaging according to self-reported (choice and purchase intention) and attentional measures as regards the ingredient area (TFF, TFD, FC). When the sphericity assumption was violated, Greenhouse-Geisser corrections were used to compensate for this. Bonferroni post-hoc tests were performed to identify any specific statistically significant effects.

4. RESULTS

4.1. Manipulation check of attention paid to brand, ingredients and content areas

The packaging of each of the snacks was composed of three areas: the brand, the ingredients, and the content. The brand and the content areas were the same on all three types of packaging, and the only aspect that was different was the ingredients. In order to verify whether there were any statistically significant differences among the various snacks according to the area of interest (brand and content), repeated measure ANOVAs were calculated, using the type of ingredient as a within-subject factor.

There were no statistically significant differences as regards the brand area according to the type of snack or as regards the TFF ($F(2,30) = 2.86$, $p = .073$, $\eta^2 = .160$) or the TFD ($F(2,88) = .19$, $p = .831$, $\eta^2 = .004$). In the case of the FC, however, there were statistically significant differences ($F(1.73, 77.92) = 4.84$, $p = .014$, $\eta^2 = .097$) between the seaweed

(M = 1.74, SD = .33) and the quinoa (M = .88, SD = .18) in favour of the seaweed [*Bonferroni*= .86, p = .028].

With regard to the content, it was not possible to calculate a statistical test with which to observe possible differences. Only three people fixed on the content area of the seaweed snack, while there were two for the chocolate snack and one for the quinoa snack.

In addition to these tests, it was noted that the participants' attention was focused on the ingredient area. This was done using heat maps, as shown in Figure 3. These maps indicate both where the majority of fixations are focused (shown in red), and where the more sporadic fixations are focused (shown in blue). The decision was, therefore, made to carry out an in-depth analysis of only the ingredient area.

Figure 3. Heat maps of the three snacks analysed (A: Seaweed; B: Chocolate; C: Quinoa).

4.2. Correlation among attention, choice and intention to purchase the snacks

Pearson's bivariate correlations were then employed in order to discover whether there was any type of relationship between the dependent variables measured, i.e. between the attentional measures and the self-reported measures (see Table I). With regard to the attentional measures, there was a statistically significant and negative correlation only between TFF and FC (r = -.41, p = 0,006). In the case of the two stated measures, there was a positive relationship between the snack choice and the snack preference (r = .59, p < 0,001). Finally, with regard to the difference between the attentional measures and the stated measures, there was a positive relationship only between TFD and snack choice (r = .35, p = .023).

Table I. Descriptive statistics and correlations among dependent variables

4.3. Attentional measures

Descriptive data for all dependent variables are presented in Table II. As can be seen in Table III, repeated measures ANOVAs for the three attentional variables yield significant interactions only in time to first fixation on the snack. In addition, possible differences were statistically tested for each condition and are shown in Figure 4.

It can be stated that those measures (Time to first fixation, Total fixation duration, Fixation count, Snack choice and Snack preference) of the snack were analysed by carrying out a repeated measure ANOVA, using the habit of consuming healthy snacks

as a between-subject factor and the type of packaging as a within-subject factor. Statistical data and effects can be found in Tables II and III.

4.3.1. Time to first fixation

The TFF according to the snack had a significant effect (F(1,55, 35,74) = 3.55, p = .050, η^2 = .134). There were specifically significant differences between seaweed and quinoa in favour of quinoa [*Bonferroni* = .607.66, p = .023]. However, the interaction of the TFF with healthy eating habits was not significant (F(1,55, 35,74) = 1.23, p = .295, η^2= .051), and this was also the case of the between-subject factor of healthy eating habits (*$F(1,23)$ = .21, p = .648, η^2= .009*).

4.3.2. Total fixation duration

The TFD had no significant effect according to the snack (F(2,46) = .19, p = .825, η^2 = .008), and this was also the case of the interaction between the TFD and the healthy eating habits ($F_{2,46}$ = .82, p = .447, η^2_{partial} = .034) and of the healthy eating habits (F(1,23) = .66, p = .426, η^2= .028).

4.3.3. Fixation count

The FC according to the type of snack had no significant effect (F(2,46) = 1.95, p = .155, η^2= .078), and this was also the case of the interaction between the FC and the healthy eating habits (F(2,46) = 1.27, p = .292, η^2 = .052) and the habit of consuming healthy snacks (F(1,23) = .02, p = .878, η^2= .001).

4.4. Snack choice

The snack choice had a significant effect (F(2,90) = 5.30, p = .007, η^2 = .105). When asked to choose between seaweed and quinoa, the participants specifically chose quinoa [*Bonferroni*= .65, p = .008]. However, the interaction between snack choice and healthy eating habits was not significant (F(2,90) = .94, p = .394, η^2= .020), and this was also the case of healthy eating habits (F(1,45) = .10, p = .750, η^2 = .002).

4.5. Snack preference

The preference according to the type of snack had a significant effect (F(2,90) = 7.81, p = .001, η^2 = .148). When asked to choose between seaweed and chocolate, the participants specifically chose chocolate [*Bonferroni*= .88, p = .006], while when asked

to choose between seaweed and quinoa, they chose quinoa [*Bonferroni*= .74, p = .002]. However, there were no statistically significant differences as regards the interaction between snack choice and healthy eating habits (F(2,90) = 2.63, p = .078, η^2 = .078) or as regards healthy eating habits (F(1,45) = .43, p = .514, $\eta^2_{partial}$ = .010).

Table II. Descriptive statistics for the attentional and stated measures regarding the snacks

Table III. Summary of the statistics obtained with the repeated measure ANOVAs for the five dependent variables

Figure 4. Attentional differences according to the type of ingredients (Seaweed, Chocolate and Quinoa) of the healthy snacks

5. DISCUSSION

One of the greatest potential benefits of experimental psychology and cognitive neuroscience, at least in their application to the field of packaging design, is that they provide more objective measures (Piqueras-Fiszman *et al.*, 2013). These behavioural and psychophysical measures (Stoll et al., 2008) highlight which sensory attribute(s) of packaging are enhancing consumer response to a particular product (Ares *et al.*, 2013; Vidal *et al.*, 2013; Reale and Flint, 2016). Hence, it is important to consider this link between the field of sensory analysis and neuroscience, with eye tracking being the methodology that can currently bring them together.

Therefore, the importance of the application of neuroscientific tools to the field of marketing research lies in the fact that their use makes it possible to discover how the consumer reacts to the stimuli presented (i.e., the healthy snack packaging researched in this study) and to obtain objective data on these reactions. Eye tracking is, therefore, an ideal resource with which to analyse consumer behaviour (Hübner *et al.*, 2010; Meißner and Oll, 2019; Casado-Aranda *et al.*, 2020; Motoki *et al.*, 2021) and consequently design a correct and appropriate package that will attract the consumer's attention, thus increasing the probability of purchase and, therefore, future sales of the product.

With regard to the design of the three types of packaging used in this study, what most attracted the attention of all the participants was the central area of the packaging, i.e., that corresponding to the ingredients. This area provided a graphic representation of the

ingredients of the snacks together with a short text concerning those ingredients, while the brand and the contents were the same on the three snacks presented. Analysing how the different ingredients may affect both attentional aspects and future intention to purchase the snacks is, then, the principal contribution of this study. In the study conducted by Ares *et al.* (2013), ingredients were as relevant as nutritional information for estimating the healthiness and willingness to buy of the products evaluated. Consequently, consumers require better information about certain ingredients (e.g., seaweed) or new products on the packaging in order to overcome unfamiliarity that could lead to consumer distrust about the taste of a healthy product (Tuorila and Cardello, 2002).

Relationship between attention and the self-report

With regard to the eye tracking data obtained, it is possible to conclude that the more time that passes before the first fixation, the fewer the number of fixations on the packaging there will be. This result is coherent, since the longer it took to look at a snack, the less time there was to study it in detail, given the limited amounted of time during which each stimulus was shown.

Furthermore, it was discovered that those consumers who showed a greater interest in choosing a particular snack showed on the study had a greater intention to purchase it. This finding is also logical, since there is a tendency to purchase those products for which a certain preference already exists. Previous studies concur with this conclusion by highlighting the importance of the visual design of a package as a way to alter consumers' perceptions (Ballco *et al.*, 2020, Creusen and Schoormans, 2005; Chandon, 2013).

When relating the stated and attentional variables, it was discovered that the more time that attention was paid to the snack, the more it was chosen, but that this did not lead to the confirmation of a future acquisition. This is perhaps owing to the fact that being shown the snack packaging only once is not sufficient as regards influencing future intention to purchase or even the fact that a large proportion of the sample were not in the habit of consuming healthy snacks. This result is consistent with the research of Ares *et al.* (2013) who argue that when consumers look at an unfamiliar food label, they scan it for basic information: brand name, image, nutritional information and ingredients. And they also state that the graphic design of the label can influence the prominence of this and other

information, affecting its ability to capture the consumer's attention; but the areas of labels that consumers primarily look at do not seem to change.

Differences among snacks according to attention, choice and purchase intention

This study found no effect as regards healthy eating habits or of the influence of these habits on the variables measured. This may indicate that consuming healthy snacks was similar among all the participants.

There was, however, a significant effect as regards the TFF according to the snack, between seaweed and quinoa in favour of quinoa. One possible explanation for this may be that the packaging of the quinoa snack was the least striking of the three. A significant effect of the choice of snack when having to choose between seaweed and quinoa was also detected, as quinoa was chosen more frequently. As indicated in previous literature, the attractiveness of the ingredients on the packaging is fundamental, such that those ingredients that are less desirable are chosen less, as occurred with the snack that contained seaweed (Ballco *et al.,* 2020; Tuorila and Cardello, 2002).

Finally, with regard to the purchase intention according to the type of snack when confronted with the choice of seaweed and chocolate, the participants preferred chocolate, and when confronted with that of seaweed and quinoa, they preferred quinoa. To continue with the line of argument shown above, chocolate would appear to be the most desirable of the three ingredients presented and, therefore, the preferred option for future consumption. These results are consistent with previous studies like these of Motoki *et al*. (2018), or Spielvogel *et al*. (2018), which states that foods with more hedonic components (flavour, e.g., chocolate) are much more visually attractive in the long run.

Taken together, these results provide interesting insights into how consumers process and interpret the images on packaging, and how this could affect their intention to buy a healthy snack (Küster-Boluda and Vila, 2020).

5.1. Managerial implications

This research highlights the use of eye tracking by companies or brands in order to achieve greater effectiveness as regards the design of their product’s packaging, in this case, a healthy snack. This tool helps brands to make decisions about packaging design by allowing the identification of the visual and aesthetic elements that best match the company’s idea of how to communicate the advantages of its product. An analysis of the

514 data obtained from the eye tracking allows the design to be improved and more positive
515 results to be achieved by influencing purchasing decisions.

516 The outcomes of this research confirm that, when designing the packaging of healthy
517 snacks, it is necessary to focus more on the central part of the packaging, which should
518 show the composition of the food and its appearance with a real image of it. This will
519 allow the consumer to see the ingredients of the food clearly and be able to decide more
520 easily (Vidal *et al.,* 2013; Küster-Boluda and Vila, 2020). When nutritional information
521 is shown in the form of health logos or according to the traffic light system, it appears to
522 capture visual attention and encourages consumers to spend more time processing
523 nutritional information (Reale and Flint, 2016).

524 According to Ares et al. (2013), not much information is available on whether consumers'
525 attention to food label information is primarily determined by the package and label
526 design (bottom-up factors) or by their search for specific information (top-down factors).
527 These authors also state in their research that consumer attention to food label information
528 in deciding their purchase intent may have been determined primarily by top-down
529 factors.

530 Rebollar *et al.* (2015) state that there are certain packaging positions that go more
531 unnoticed, such as the lower zone, and others, such as the upper part (especially the upper
532 left), where the subject's attention is unconscious and automatic. They also argue that
533 intuitive reactions can be modified by adding design elements that stand out from the rest,
534 taking care of the position so as not to lose communicative effectiveness.

535 **5.2. Limitations and future research**

536 One of the limitations found, which occurs with the majority of experiments of this nature,
537 is the attainment of data in an artificial environment. The ideal situation would have been
538 that of attaining the information in a real purchasing environment, and the main reason
539 for not doing so was employing a non-wireless device. In future studies, we shall
540 additionally increase the size of the sample, which would be appropriate as regards being
541 able to generalise the results to the population as a whole.

542 As a future line of research, we propose to carry out a comparative analysis of other
543 similar products from the range analysed herein, such as other varieties or other
544 commercial formats. Another future line of research might be to carry out an experiment
545 in which certain graphic elements of the packaging are modified, as would be the case of

measuring the attention paid by each individual participant to healthy products contained in transparent packaging that would allow them to see the product before purchasing it. Adding transparent elements to the packaging might, therefore, influence the decision to purchase and influence the consumer's perception in a more reliable manner (Billeter *et al*., 2012; Deng and Srinivasan, 2013; Simmonds and Spence, 2017) when the product is visually attractive. It might even be possible to modify elements such as the external colour of the packaging. Authors such as Huang and Lu (2016) analysed the effect of the colour of packaging and demonstrated that consumers perceive products in blue packaging to be healthier than those in red packaging. Future research could analyse the influence of nutrition warnings and verbal and nonverbal cues on the perception of different consumer segments. In addition, other possible visual prominence factors such as brightness and colour could have been analysed (Rebollar *et al.*, 2015).

Conflicts of Interest

The authors declare no conflict of interest.

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Table I. Descriptive statistics and correlations among dependent variables

Variables	M	SD	N	1	2	3	4	5
1. Time to first fixation (TFF)	1232.81	1043.84	43	—				
2. Total fixation duration (TFD)	325.17	133.87	43	-.02	—			
3. Fixation count (FC)	3.38	2.29	43	-.41**	.04	—		
4. Choice	2.96	.82	47	.10	.35*	-.01	—	
5. Preference	3.09	.71	47	-.07	-.03	.25	.59**	—

* $p \leq .050$; ** $p \leq .010$.

Table II. Descriptive statistics for the attentional and stated measures regarding the snacks

Variables	Seaweed		Chocolate		Quinoa	
	M	*SD*	*M*	*SD*	*M*	*SD*
TFF	1317.06[a]	256.84	1130.02[a,b]	254.24	709.39[b]	119.21
TFD	323.49	51.28	333.29	33.61	360.59	43.76
FC	4.21	.55	4.41	.55	5.04	.54
Choice	2.63[b]	.18	3.04[a,b]	.18	3.28[a]	.17
Preference	2.58[b]	.19	3.46[a]	.19	3.32[a]	.16

Note: mean values on the same line that do not have the same superscript are significantly different from one another ($p < .05$) according to pairwise comparison with the Bonferroni test.

Table III. Summary of the statistics obtained with the repeated measure ANOVAs for the five dependent variables

Variables	df (df Error)	*F*	*p*	*η2*
Time to first fixation				
Main effect condition	1.55 (35.74)	3.55	.050*	.134
Main effect item	1 (23)	.21	.648	.009
Interaction	1.55 (35.74)	1.23	.295	.051
Total fixation duration				
Main effect condition	2 (46)	.19	.825	.008
Main effect item	1 (23)	.66	.426	.028
Interaction	2 (46)	.82	.447	.034
Fixation count				
Main effect condition	2 (46)	1.95	.155	.078
Main effect item	1 (23)	.02	.878	.001
Interaction	2 (46)	1.27	.292	.052
Choice				
Main effect condition	2 (90)	5.30	.007**	.105
Main effect item	1 (45)	.10	.750	.002
Interaction	2 (90)	.94	.394	.020
Preference				
Main effect condition	2 (90)	7.81	.001***	.148
Main effect item	1 (45)	.43	.514	.010
Interaction	2 (90)	2.63	.078	.078

*$p \leq .050$; ** $p \leq .010$; *** $p \leq .001$. *Note.* Main effect condition refers to ingredient type; main effect item refers to healthy consumption habits; interaction is between ingredient type and healthy consumption habits.

Figure 1. Stimuli provided: A) seaweed, B) chocolate, C) quinoa. Delimited areas of interest (brand, ingredients and content).

Figure 2. Example of procedure employed to register eye movement.

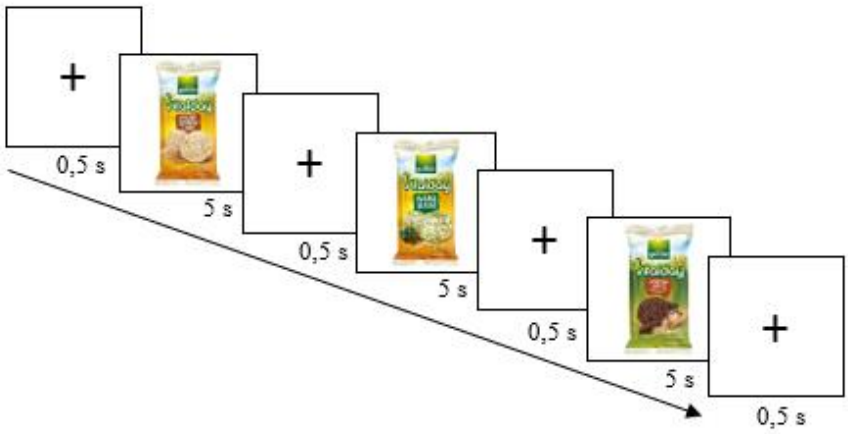

Figure 3. Heat maps of the three snacks analysed.

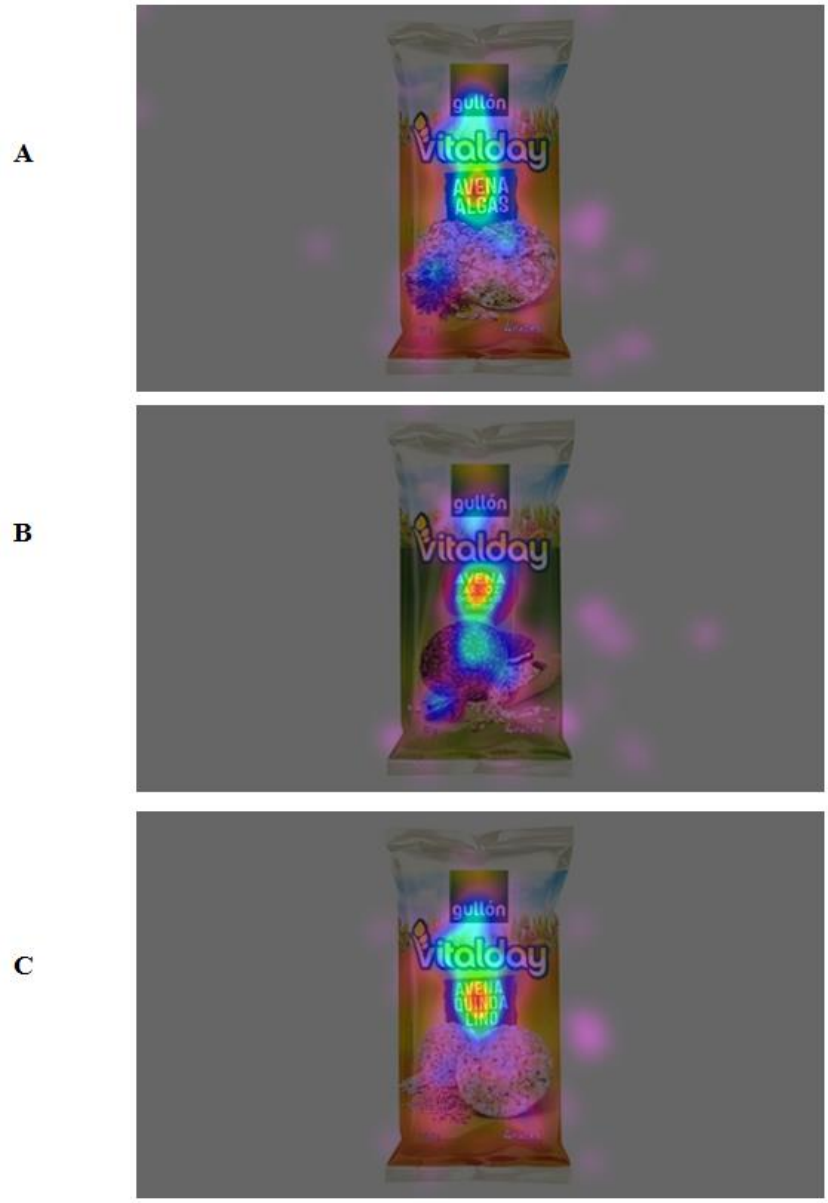

Figure 4. Attentional differences according to the type of ingredients of the healthy snacks