



References to home-made and natural foods on the labels of ultra-processed products increase healthfulness perception and purchase intention: Insights for policy making

Gabriela Devia^a, Stefani Forli^a, Leticia Vidal^b, María Rosa Curutchet^c, Gastón Ares^{a,b,*}

^a Centro de Investigación Básica en Psicología, Facultad de Psicología, Universidad de la República, Tristán Narvaja, CP 11200 Montevideo, Uruguay

^b Sensometrics & Consumer Science, Instituto Polo Tecnológico de Pando, Facultad de Química, Universidad de la República, By Pass de Rutas 8 y 101 s/n, CP 91000, Pando, Canelones, Uruguay

^c Observatorio de Seguridad Alimentaria y Nutricional, Instituto Nacional de Alimentación, Piedras 165. CP 11000, Montevideo, Uruguay

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ABSTRACT

As nutritional recommendations change, new marketing strategies are expected to appear on food labels to convey the idea that products are healthful and aligned with the recommendations. In this context, the objective of the study was to evaluate the effect of references to 'home-made', images of natural foods and nutritional warnings on consumers' healthfulness perception and purchase intention of labels of ultra-processed products with excessive content of nutrients associated with non-communicable diseases (NCDs). The study was conducted with 790 Uruguayan Facebook users (65% female, 18–89 years old), diverse in terms of educational and socio-economic levels. A choice experiment involving labels of four categories of ultra-processed products (burgers, cookies, instant soup and instant vanilla milk custard) was implemented. For each product category, eight sets of two labels differing in the presence of references to home-made, images of natural foods and nutritional warnings were designed. Half of the participants were asked to indicate the healthier product, whereas the other half were asked to indicate the product they would purchase. Data were analyzed using mixed logit models. The inclusion of references to home-made and images of natural foods on the labels had a positive effect on purchase intention and tended to create the belief that products were healthful. Nutritional warnings decreased healthfulness perception and discouraged participants' choice. In three of the product categories images of natural foods created a health halo that reduced the effect of nutritional warnings on product choice. Results from the present work suggest the need to develop stricter labelling regulations for ultra-processed products with high content of nutrients associated with NCDs.

1. Introduction

The increased availability and affordability of ultra-processed products in the food environment has been identified as one of the main factors underlying the alarming rise in the prevalence of obesity and non-communicable diseases (Popkin, 2017; Swinburn et al., 2019; Vandevijvere et al., 2019). Ultra-processed products can be defined as "formulations of ingredients, mostly of exclusive industrial use, that result from a series of industrial processes" (Monteiro et al., 2019). These products usually have low nutritional value and contain excessive content of free sugars, total fat, saturated fat and sodium, as well as different artificial additives (Pan American Health Organization, 2019; Luiten,

Steenhuis, Eyles, Ni Mhurchu, & Waterlander, 2016). A growing body of evidence shows that consumption of these products is associated with adverse health outcomes, including obesity (Canella et al., 2014), hypertension (Mendonça et al., 2016), cardiovascular diseases (Srour et al., 2019), increased overall cancer risk (Fiolet et al., 2018), and all-cause mortality (Kim, Hu, & Rebholz, 2019).

Companies use a multifaceted array of marketing techniques to promote and induce sales of ultra-processed products, including labelling design (Pan American Health Organization, 2019). Food labels are an important tool for communicating product information, attracting consumers' attention at the point of purchase, and influencing perceived quality and purchase intention (Chambault, 2016). Textual and visual

* Corresponding author at: Sensometrics & Consumer Science, Instituto Polo Tecnológico de Pando, Facultad de Química, Universidad de la República, By Pass de Rutas 8 y 101 s/n, CP 91000, Pando, Canelones, Uruguay.

E-mail address: gares@fq.edu.uy (G. Ares).

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cues on food labels trigger a wide range of associations in consumers' minds that may influence their purchase decision (Carey, 2009). The contribution of labelling and packaging to the marketing mix of food companies has increased over the last years. In 2019, the food packaging market was valued at 301 billion US dollars worldwide and was expected to reach 411 billion in 2025, growing at a 5.5% annual rate (Mordor Intelligence, 2020).

The labels of ultra-processed products frequently include a wide range of textual and visual cues to convey health-related associations (Christoforou, Dachner, Mendelson, & Tarasuk, 2018). Research has shown that the labels of these products frequently include a considerable number of nutrition marketing claims related to their production or formulation (e.g. vegan, halal), the presence of specific ingredients (e.g. 'whole grain', 'no colorings') or their nutrient content (e.g. 'high in fiber' or 'source of vitamin C'), irrespectively of their nutritional composition (Christoforou et al., 2018; Hieke et al., 2016; Schermel, Emrich, Arcand, Wong, & L'Abbé, 2013). These nutrition marketing claims have been reported to not only increase healthiness perception but also purchase intention (Nobrega, Ares, & Deliza, 2020; Saba et al., 2010; van Trijp & van der Lans, 2007). In addition, nutrition-related claims may create a health halo, i.e. the perception that a product is healthier than it is (Chandon, 2013). This halo can override the effect of objective information about the nutritional composition of products (Andrews, Netemeyer, & Burton, 1998; Roe, Levy, Brenda, & Derby, 1999; Sütterlin & Siegrist, 2015).

As new scientific knowledge emerges and nutritional recommendations change, new marketing strategies are expected to appear on food labels to convey the idea that products are healthful and aligned with the recommendations. In this sense, new public health recommendations related to increasing consumption of natural and minimally processed foods and home-made culinary preparations (Monteiro et al., 2015) can potentially trigger the use of references to such characteristics on labels. In this sense, recent research has reported the use of the terms "home-made" and "traditional" on the labels of packaged processed products in the Brazilian marketplace (Machado, dos Antos, Uggioni, Fabri, & Müller, 2018). Similarly, products including imagery and words that suggest small-scale or domestic production (e.g. 'grandmother-style', 'craft') on the labels have been reported in the European market (BEUC, 2018). The use of this type of information on food labels can influence consumer perception of ultra-processed products. However, the effect of references to natural foods or home-made meals has not received much attention in the literature. Only few studies have shown that the inclusion of reference to fruit can increase healthfulness perception and choice (Arrúa et al., 2017; Sütterlin & Siegrist, 2015).

Labelling regulations are increasingly used to discourage consumption of products with excessive content of nutrients associated with non-communicable diseases (Bergallo, Castagnari, Fernández, & Mejía, 2018; Zhang, Liu, Liu, Xue, & Wang, 2014). In this sense, nutritional warnings have been proposed as a front-of-pack (FOP) nutrition labelling scheme to highlight products with excessive content of nutrients associated with obesity and non-communicable diseases (Khandpur, Swinburn, & Monteiro, 2018). This scheme has been implemented in several Latin American countries as black octagons with the expression "High" or "Excess", followed by the corresponding nutrient -sugar, fat, saturated fat and sodium- (e.g. de Salud, 2016, 2018; de Economía, 2020). Recent research has shown that warnings cause a salience bias, making the negative health consequences of sugar, fat and sodium salient on consumers' mind (Ares et al., 2020). The inclusion of warnings on food packages has proven to be effective at discouraging consumption of products with excessive content calories, sugars, saturated fat and sodium (Acton and Hammond, 2018a, 2018b; Ares, Aschemann-Witzel, Curutchet et al., 2018; Ares, Aschemann-Witzel, Vidal et al., 2018; Arrúa et al., 2017; Khandpur, de Moraes et al., 2018; Machín, Curutchet, Giménez, Aschemann-Witzel, & Ares, 2019). In addition, warnings seem to reduce the effect of some of the marketing strategies included on food labels to create health-related associations, such as

claims, references to fruit and cartoon characters (Acton and Hammond, 2018a, 2018b; Arrúa et al., 2017; Centurión, Machín, & Ares, 2019; Nobrega et al., 2020). However, an in-depth understanding of the relative impact of nutritional warnings compared to other label elements is still lacking.

In this context, the aim of the present work was to evaluate the effect of references to 'home-made', images of natural foods and nutritional warnings on consumers' healthfulness perception and purchase intention of labels of ultra-processed products. It was hypothesized that, across product categories, the inclusion of references to 'home-made' or images to natural foods on food labels would increase healthfulness perception and purchase intention, whereas nutritional warnings would have the opposite effect.

The research was conducted in Uruguay, one of the countries with the highest rates of overweight and obesity in Latin America (64.9% among adults) (de Salud, 2015). Uruguay approved the compulsory inclusion of warnings on the packages of foods with excessive content of sugar, total fat, saturated fat and sodium in 2018 (de Salud, 2018). The study was conducted during the adaptation period granted the food industry to include the warnings on the packages.

2. Materials and methods

2.1. Participants

A convenience sample of participants was obtained using a Facebook advertisement targeted at Uruguayan adult users. The methodological decision to use Facebook as recruitment method was based on the fact that social media is widespread in the Uruguayan population and that Facebook is the most popular network in the country (Grupo Radar, 2017). A total of 790 participants (18–89 years old), diverse in terms of gender, socio-economic status and education level, completed the study.

Table 1
Socio-demographic characteristics of the participants, both at the aggregate level and separately for participants who evaluated healthfulness perception and purchase intention.

Characteristic	Percentage of participants (%)		
	All participants (n = 790)	Healthfulness perception (n = 377)	Purchase intention (n = 413)
<i>Gender</i>			
Female	65	64	66
Male	35	36	34
<i>Age</i>			
18–25	18	17	19
26–35	21	22	21
36–45	18	19	17
46–55	16	15	17
56–65	19	20	17
66 or more	8	7	9
<i>Educational level</i>			
Primary school	16	16	16
Secondary school	49	47	51
Technical education	8	8	6
University	21	23	20
Post-graduate studies	6	6	7
<i>Socio-economic level *</i>			
Low	17	17	18
Medium	60	60	59
High	23	23	23

* Socio-economic level was estimated using the methodology proposed by the Uruguayan Center of Economic Research (Centro de Investigaciones Económicas, 2016).

Table 1 shows the description of the participants in terms of their socio-demographic characteristics. Compared to the Uruguayan population, the sample overrepresented females and younger consumers. The study was approved by the Ethics committee of the School of Chemistry of Universidad de la República (Uruguay). Participants completed an informed consent form. The study was conducted between August and September 2019.

2.2. Stimuli

Four food categories were selected as case study: burgers, cookies, instant soup and instant vanilla milk custard. The selection of the categories was based on their popularity in the country and the existence of similar home-made products.

For each of the categories, eight labels were designed following a full-factorial experimental design with three 2-level variables: references to home-made (present vs. absent), images of natural foods (present vs. absent) and nutritional warnings (present vs. absent). All the labels included a picture of the product, as well as a fictitious brand name.

References to home-made were operationalized using the claim 'Home-made type' and the image of a wooden surface. When the labels included references to home-made, the product was located on top of the wooden surface that mimicked a home environment. On the contrary, when labels did not include references to home-made, the product was located on a plain background (Fig. 1). The variable 'Images of natural foods' was operationalized by including images of natural foods (ingredients or side dishes, depending on the characteristics of the product category), next to the target product (Fig. 1). Finally, nutritional warnings were included on the labels according to the nutrient composition of commercial products available in the Uruguayan market and the criteria for excessive content of nutrients set on the Uruguayan regulation (Ministerio de Salud Pública, 2018). The warnings corresponded to black octagons with a white background that included the word EXCESS, followed by the corresponding nutrient, and the initials of the Ministry of Public Health (MSP in Spanish) (Fig. 1). Table 2 shows a summary of how the variables were operationalized for each of the product categories.

Using the 8 labels generated by the experimental design (i.e.

Table 2

Description of how the variables considered in the design of the labels were operationalized in each of the four product categories included in the study.

Category	References to home-made	Images of natural foods	Nutritional warnings
Burgers	'Home-made type' and Wooden background	Lettuce, tomato and onion	Excess of saturated fat and sodium
Cookies	'Home-made type' and Wooden background	Oat and framboise	Excess of fat and sugar
Instant vanilla milk custard	'Home-made type' and Wooden background	Eggs and milk	Excess of sugar
Instant soup	'Home-made type' and Wooden background	Pepper, onion, tomato, parsley, lemon and herbs	Excess of sodium

Note: According to Uruguayan regulations, the following thresholds are considered for excessive content of nutrients on products with added sugar, fat and/or sodium (Ministerio de Salud Pública, 2018): Excess of sugar (>3g/100 g and calories from sugar > 20%), Excess of fat (calories from fat > 35%), Excess of saturated fat (calories from saturated fat > 12%), Excess of sodium (>500 mg/100 g or 8 > mg/kcal).

corresponding to all possible combinations of the levels of the variables), eight sets of labels were formed for each product category using the mix-and-match procedure (Johnson, Kanninen, Bingham, & Ozdemir, 2007). The characteristics of the two labels included in each of the sets are presented in Table 3. The labels were presented next to each other, as exemplified in Fig. 1. Price information was not provided. The position of the labels within the set was randomized. Labels were designed by a professional graphic designer.

2.3. Experimental procedure

Participants were randomly allocated to one type of evaluation (healthfulness perception or purchase intention) and two of the four product categories. Therefore, each participant evaluated 16 choice sets, corresponding to the assessment of one construct in two product categories. A total of 377 participants evaluated healthfulness perception, whereas 413 evaluated purchase intention (Table 1). The number of



Fig. 1. Examples of the pairs of labels generated following a full-factorial design with the variables references to home-made, images of natural foods and nutritional warnings, for four categories of ultra-processed products: (a) burgers, (b) cookies, (c) instant vanilla milk custard, (d) instant soup.

Table 3

Characteristics of the labels included in each of the eight choice sets of the choice experiment.

Set	Label 1			Label 2		
	References to home-made	Images of natural foods	Nutritional warnings	References to home-made	Images of natural foods	Nutritional warnings
1	Absent	Present	Absent	Absent	Absent	Present
2	Present	Absent	Present	Present	Present	Present
3	Present	Present	Present	Present	Absent	Absent
4	Absent	Absent	Present	Absent	Present	Present
5	Absent	Absent	Absent	Present	Absent	Present
6	Absent	Present	Present	Present	Present	Absent
7	Present	Absent	Absent	Absent	Present	Absent
8	Present	Present	Absent	Absent	Absent	Absent

participants who evaluated each product category ranged between 187 and 212.

Participants completed a choice experiment. They were presented with the 16 sets of 2 labels, corresponding to the two product categories. The 16 sets were presented 1 by 1, following a Williams' Latin Square experimental design to minimize order and carry over effects. For each of the sets of 2 labels, participants were asked to look at the labels and to answer the corresponding question. In the healthfulness evaluation they had to answer the question "Which is the more healthful product?", whereas in the evaluation of purchase intention the question was "Which product would you purchase?" The option 'None of the products' was available. After completing the choice experiment, participants had to answer a series of attitudinal and socio-demographic questions.

2.4. Data analysis

Data were analyzed separately for each product category and type of evaluation (healthfulness or purchase intention) using a mixed logit model with random parameters (Scarpa, Ferrini, & Willis, 2005). For each product within a choice set of 2 labels, participants' choice was coded using a binary dependent variable (0/1). The main effect of the variables of the experimental design (references to home-made, images of natural foods and nutritional warnings) and their interaction effects were estimated. The mixed logit model assumes that participants select the label that maximizes their utility (i.e. their benefit) in each choice set. The utility of the alternative j for participant n can be estimated as follows:

$$U_{nj} = \beta_n x_{nj} + \varepsilon_{nj}$$

where

n represents each of the participants

t represents each of the 8 choice situations faced for a product category

j represents each of the 2 alternatives in each of the choice sets

U is the utility that participant n derives from alternative j in the choice set t

x_{nj} is a vector of explanatory variables that describe alternative j , including the variables of the experimental design and their interaction and descriptors of the choice situation t

β_n is a vector of coefficients of the variables for participant n

ε_{nj} is a random term

The model assumes that the coefficients vary across consumers following a normal distribution. The socio-demographic characteristics of participants were not included in the model, given that no significant differences were found between the groups in their gender, age, educational level and socio-economic status distributions (all p -values higher than 0.25). The average coefficients, their standard deviation and significance were estimated. The analysis was performed using the `gmln` package (Sarrias, Daziano, & Croissant, 2017) in R software (R Core Team, 2019).

3. Results

3.1. Healthfulness perception

Table 4 shows the average coefficients of the mixed logit model with random parameters used to analyze the effect of the experimental variables on healthfulness perception for four categories of ultra-processed foods. The coefficient of nutritional warnings was negative and significantly different from zero, suggesting that the presence of nutritional warnings on the labels reduced healthfulness perception. For three of the categories (burgers, instant vanilla milk custard and instant soup), nutritional warnings had the largest coefficient, suggesting that they had the largest influence on healthfulness perception.

The coefficients of the variable 'References to home-made' were positive and significant for three of the categories (cookies, instant vanilla milk custard and instant soup), which indicates that they increased healthfulness perception. Similarly, the coefficients of the variable 'Images of natural foods' were positive and significant for two of the four categories (instant vanilla milk custard and instant soup).

Although most of the interaction effects were not significant (Table 4), the interaction between the variables 'References to home-made' and nutritional warnings was significant for three of the categories (cookies, instant vanilla milk custard and instant soup). In the three cases the coefficients were negative, which indicates that the

Table 4

Average coefficients of the effects included in the mixed logit model used to estimate the influence of characteristics of labels on healthfulness perception in the choice experiment for each of the four categories of ultra-processed products.

Effect	Product category			
	Burgers (n = 187)	Cookies (n = 190)	Instant vanilla milk custard (n = 189)	Instant soup (n = 188)
<i>Main effects</i>				
References to home-made	0.45 ^{ns}	2.14 *	1.23*	1.78*
Images of natural foods	0.36 ^{ns}	0.34 ^{ns}	0.67*	0.70*
Nutritional warnings	-1.48*	-0.89*	-2.09*	-2.33*
<i>Interactions</i>				
References to home-made: Images of natural foods	0.29 ^{ns}	-0.26 ^{ns}	-0.21 ^{ns}	-0.21 ^{ns}
References to home-made: Nutritional warnings	-0.31 ^{ns}	-0.83*	-0.50 *	-0.57*
Images of natural foods: Nutritional warnings	-0.14 ^{ns}	0.27 ^{ns}	-0.19 ^{ns}	0.10 ^{ns}

Notes: The number of participants who evaluated each of the product categories is indicated between brackets next to the name of the category. Coefficients highlighted with * are significantly different from 0 for a significance level of 0.05, whereas coefficients with ^{ns} are not significantly different from 0 for a significance level of 0.05.

presence of nutritional warnings reduced the positive effect of the inclusion of references to home-made on healthfulness perception.

3.2. Purchase intention

The average coefficients of the mixed logit model with random parameters used to analyze the effect of the experimental variables on purchase intention are shown in Table 5. Nutritional warnings showed negative and significant effects for all the categories except for cookies, suggesting that they were able to discourage participants' choice. On the contrary, the coefficients of the variables 'References to home-made' and 'Images of natural foods' were positive and significant for all the categories, which indicates that they encouraged participants' choice.

The absolute value of the coefficients showed that the relative effect of nutritional warnings and 'References to home-made' was similar for burgers. For instant vanilla milk custard, the coefficient for references to home-made had a higher absolute value compared to that of nutritional warnings. Meanwhile, the opposite trend was found for instant soup.

As for healthfulness perception, the coefficient of most of the interaction effects of the variable 'References to home-made' were not significant. As shown in Table 5, the coefficient of the interaction between 'References to home-made' and 'Images of natural foods' was negative for the category instant vanilla milk custard, suggesting that the inclusion of images of natural foods on the labels reduced the positive effect of the inclusion of references to home-made on purchase intention. A similar effect was found for nutritional warnings and 'References to home-made' on cookies.

The interaction between nutritional warnings and images of natural foods was positive and significant for three categories (burgers, cookies and instant soup). This suggests that the inclusion of images of natural foods on the labels reduced the ability of nutritional warnings to discourage participants' choice.

4. Discussion

Labelling regulations are necessary to protect consumers from misleading information and to restore the information imbalance that

Table 5

Average coefficients of the effects included in the mixed logit model used to estimate the influence of characteristics of labels on purchase intention in the choice experiment for each of the four categories of ultra-processed products.

Effect	Product category			
	Burgers (n = 207)	Cookies (n = 212)	Instant vanilla milk custard (n = 201)	Instant soup (n = 206)
<i>Main effect</i>				
References to home-made	1.24*	1.84*	1.98*	1.57*
Images of natural foods	0.59*	0.53*	0.98*	0.56*
Nutritional warnings	-1.21*	0.40 ^{ns}	-1.13*	-2.00*
<i>Interactions</i>				
References to home-made: Images of natural foods	0.22 ^{ns}	0.06 ^{ns}	-0.37*	-0.01 ^{ns}
References to home-made: Nutritional warnings	-0.25 ^{ns}	-0.56*	-0.27 ^{ns}	-0.05 ^{ns}
Images of natural foods: Nutritional warnings	0.37*	0.30*	0.30 ^{ns}	0.49*

Notes: The number of participants who evaluated each of the product categories is indicated between brackets next to the name of the category. Coefficients highlighted with * are significantly different from 0 for a significance level of 0.05, whereas coefficients with ^{ns} are not significantly different from 0 for a significance level of 0.05.

exists between manufacturers and consumers (FAO, 2016; Fung, Weil, Graham, & Fagotto, 2004). In this context, the present work aimed at providing insights for policy making by exploring how the inclusion of references to home-made and images of natural foods on the labels of ultra-processed products influence healthfulness perception and purchase intention. Results from the study showed that the presence of both elements on the labels had a positive effect on purchase intention. In addition, references to home-made and images of natural foods created a health halo, i.e. created the belief that products were healthful. The effect of references to home-made on healthfulness perception was significant in three of the four categories, whereas the effect of images of natural foods was significant in two categories.

The influence of references to home-made on perceived healthfulness and purchase intention can be explained by the associations raised by this concept. Home-made foods are usually perceived as tastier and healthier than 'industrial foods' and evoke a wide range of associations related to love, happiness, family, and authenticity (Ares, Aschemann-Witzel, Curutchet et al., 2018; Ares, Aschemann-Witzel, Vidal et al., 2018; Moiso, Arnould, & Price, 2004; Petridou, 2001). In addition, recent nutritional recommendations stress the advantages of cooking from scratch at home in opposition to consuming ready-to-eat ultra-processed products (Monteiro et al., 2015).

The positive effect of images of natural foods on perceived healthfulness and purchase intention can be explained by the well-known health benefits of consuming natural foods, and particularly fruit, vegetables and grains (Ares, Aschemann-Witzel, Curutchet et al., 2018; Ares, Aschemann-Witzel, Vidal et al., 2018; Rekhy & McConchie, 2014). This result matches previous studies reporting that textual references to fruit on labels increased perceived healthfulness (Sütterlin & Siegrist, 2015; van Trijp & van der Lans, 2007) and that fruit images encourages product choice (Arrúa et al., 2017). Furthermore, food images have been extensively reported to be a salient visual stimulus that can trigger craving for food, increased hunger and encourage consumption (Simmonds & Spence, 2017). Further research should be conducted to get an in-depth understanding of the multiple effects of including images of natural food on the packages of ultra-processed products. Given the exploratory nature of the present research, different types of images were considered, including images of natural foods corresponding to ingredients (e.g. oat and framboise in cookies) and side dishes (e.g. lettuce, tomato and onion in burgers). Future studies should perform a more in-depth evaluation of the effects of different types of images of natural foods on consumer perception of ultra-processed products.

The effect of references to home-made and images of natural foods on perceived healthfulness differed between product categories. The moderator effect of product categories may be explained by participants' previous associations (Chandon, 2013). It can be hypothesized that the effect of references to home-made and natural foods is higher on ultra-processed products with a positive healthy image and that are perceived to be similar to home-made foods. In this sense, instant vanilla milk custard and instant soup may have a more positive image than burgers and cookies. Further research is needed to confirm this hypothesis and to obtain an in-depth understanding of the moderators of the health halo effects of labelling elements.

The inclusion of nutritional warnings has been suggested as one of the public policies that can contribute to raise awareness of the negative health consequences of ultra-processed products with excessive content of nutrients associated with non-communicable diseases (Khandpur, Swinburn, & Monteiro, 2018). In the present work, labels with warnings were associated with products being perceived as less healthful across the four categories and managed to discourage choice in three of the 4 categories. This result provides additional evidence about the potential of nutritional warnings to promote informed choices and to encourage more healthful diets (Arrúa et al., 2017; Acton & Hammond, 2018a, 2018b; Centurión et al., 2019; Khandpur, de Morais et al., 2018; Ares, Aschemann-Witzel, Curutchet et al., 2018; Ares, Aschemann-Witzel, Vidal et al., 2018; Machín et al., 2019). However, in most cases the

size of the effect of nutritional warnings was similar to that caused by the inclusion of references to home-made on the labels. In addition, the presence of images of natural foods tended to reduce the effect of nutritional warnings on purchase intention. Interestingly, the effect was not observed for perceived healthfulness. Thus, the presence of images of natural foods seemed to create a halo that conveyed positive associations and reduced the efficacy of nutritional warnings, as reported by other authors for other types of nutritional information (Andrews et al., 1998; Roe et al., 1999; Sütterlin & Siegrist, 2015). On the contrary, nutritional warnings diminished the positive effect of references to home-made on perceived healthfulness, suggesting that the presence of warnings may have promoted a more critical appraisal about product healthfulness. The larger detrimental effect of images of natural foods over the efficacy of warnings can be explained by the fact that imagery has been reported to be more salient, require less cognitive effort and raise more vivid associations than textual information (Gil-Pérez, Rebollar, & Lidón, 2020).

4.1. Policy implications

Results from the present work stress the need for stricter labelling regulations for ultra-processed foods with excessive content of nutrients associated with non-communicable diseases. Although most countries have regulations that protect consumers from false or deceptive advertising, the growing body of evidence that associates ultra-processed products with negative health outcomes indicates that explicit labelling regulations are in fact necessary. For instance, labelling regulations should ban the inclusion of elements that convey positive health-related associations, such as references to home-made or the inclusion of natural foods that are not the primary ingredients of the products.

The European Food Information to Consumers regulation states that food labels should not mislead consumers as to its nature, identity, properties, composition or method of production (European Commission, 2014). However, only some countries (e.g. Czech Republic) have specific regulations on the use of references to home-made products (BEUC, 2018). The UK Food Standards Agency has issued an advice to restrict the use of the term 'home-made' for "the preparation of the recipe on the premises, from primary ingredients, in a way that reflects a typical domestic situation on industrialized foods" and not to represent factory-made foods on small kitchens or farmhouses (UK Food Standards Agency, 2002). However, this advice has not yet translated into an explicit regulation. Policy makers should be aware that regulations should explicitly refer to the wide range of synonyms and visual cues that can be used to convey a concept. For example, results from Machado et al. (2018) clearly showed that a wide range of terms are included on labels to convey the concept of home-made.

Most labelling regulations do not include specific requirements on the quantity of natural ingredients a product should contain to include pictures on the label, except for a few categories (BEUC, 2018). In 2019, the US Academy of Nutrition and Dietetics urged the Food and Drug Administration to introduce regulations on the inclusion of images of healthy ingredients on the labels of on products that contain a minuscule amount of such ingredients as part of its Nutrition Innovation Strategy (Academy of Nutrition and Dietetics, 2019). According to the European Quantitative Ingredient Declarations, when labels include a representation of an ingredient on the label, the percentage of that ingredient should be declared in the list of ingredients (Commission, 2017). However, as the information is included on the list of ingredients (usually on the back of the package), consumers cannot be expected to read it. Food choices at the point of purchase are made in a short period of time without much deliberation (Machín et al., 2020). This suggests that strict labelling regulations are necessary to undermine the persuasive effect of images of natural foods on the labels of ultra-processed products.

4.2. Limitations of the study

The present research is not free from limitations. Although a diverse sample of participants were involved in the study, they cannot be regarded as representative of the Uruguayan population. Further research should be conducted to evaluate the influence of socio-demographic and attitudinal characteristics on the relative effect of packaging cues on citizens' perceived healthfulness and purchase intention of ultra-processed products.

Other limitations of the study are due to the methodological decisions regarding the design of the stimuli. A limited number of categories of ultra-processed products were considered, which indicates the need for research that confirms and expands results from the present work. In addition, the labels involved in the study were unknown to participants and did not correspond to commercial brands available in the Uruguayan marketplace. Considering the habitual nature of food choice, the relative effect of warnings is expected to be smaller compared to other labelling elements frequently employed by well-known brands. Finally, the evaluation of purchase intention was performed on a hypothetical basis as participants did not have to purchase or consume the products, and no price information was provided either. Therefore, participants' responses could be influenced by response bias and satisficing response strategies.

5. Conclusions

The inclusion of references to home-made and images of natural foods on labels can increase perceived healthfulness and purchase intention. Although nutritional warnings reduced perceived healthfulness and discouraged product choice, they had a similar relative effect than references to home-made. In addition, the efficacy of nutritional warnings was reduced when images of natural foods were present on the packages. These results suggest the need for stricter labeling regulations for products with excessive content of nutrients associated with NCDs. In particular, the regulation of imagery deserves special attention. In this sense, it should be acknowledged that regulation of visual communication could be difficult given its openness to interpretation. Although some authors have regarded the regulation of imagery elements as over-regulation (Hajer, Laws, & Versteeg, 2009), records of such regulation exist as anti-tobacco policies have managed to remove all imagery from packages (Freeman, Chapman, & Rimmer, 2008).

CRedit authorship contribution statement

Gabriela Devia: Conceptualization, Methodology, Formal analysis, Writing - review & editing. **Stefani Forli:** Conceptualization, Methodology, Formal analysis, Writing - review & editing. **Leticia Vidal:** Conceptualization, Methodology, Formal analysis, Writing - review & editing. **María Rosa Curutchet:** Conceptualization, Methodology, Writing - review & editing. **Gastón Ares:** Conceptualization, Methodology, Formal analysis, Writing - original draft, Writing - review & editing.

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