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Lost in Processing? Perceived Healthfulness, Taste and Caloric Content of Whole and Processed Organic Food

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Abstract

The "organic" claim explicitly informs consumers about the food production method. Yet, based on this claim, people often infer unrelated food attributes. The current research examined whether the perceived advantage of organic over conventional food generalizes across different organic food types. Compared to whole organic foods, processed organic foods are less available, familiar and prototypical of the organic food category. In two studies (combined $N = 258$) we investigated how both organic foods types were perceived in healthfulness, taste and caloric content when compared to their conventional alternatives. Participants evaluated images of both whole (e.g., lettuce) and processed organic food exemplars (e.g., pizza), and reported general evaluations of these food types. The association of these evaluations with individual difference variables – self-reported knowledge and consumption of organic food, and environmental concerns – was also examined.

Results showed that organically produced whole foods were perceived as more healthful, tastier and less caloric than those produced conventionally, thus replicating the well-established halo effect of the organic claim in food evaluation. The organic advantage was more pronounced among individuals who report being more knowledgeable about organic food, consume it more frequently, and are more environmentally concerned. The advantage of the organic claim for processed foods was less clear. Overall, processed organic (vs. conventional) foods were perceived as tastier, more healthful (Study 1) or equally healthful (Study 2), but also as more caloric. We argue that the features of processed food may modulate the impact of the organic claim, and outline possible research directions to test this assumption. Uncovering the specific conditions in which food claims bias consumer's perceptions

and behavior may have important implications for marketing, health and public-policy related fields.

Keywords: organic; whole food; processed food; healthfulness; taste; calories.

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Food labeling constitutes an important strategy to help consumers make food choices. These labels include claims that create expectations, which in turn influence consumer's perception, hedonic appraisal, and consumption of products (for a review, see Piqueras-Fiszman & Spence, 2015). Examples of such claims include "low fat" (Ebneter, Latner, & Nigg, 2013; Wansink & Chandon, 2006), or "low carbs" (Labiner-Wolfe, Jordan Lin, & Verrill, 2010). Research has shown that this information is often misunderstood or misinterpreted (for a review, see Provencher & Jacob, 2016). Indeed, even claims unrelated to product composition, such as "fair trade" (e.g., Schuldt, Muller, & Schwarz, 2012) or "organic" (e.g., Schuldt & Schwarz, 2010), have been shown to influence consumer perception and behavior.

The organic claim explicitly informs consumers about the food production method. However, this claim seems to represent a cluster of attributes that goes beyond production-specific characteristics (e.g., pest management, fertilizer usage and soil treatment). Specifically, organic products seem to be associated with ethical, health and environmental concerns, as well as nutrition and food safety aspects (for a review, see Fernqvist & Ekelund, 2014). The literature focusing on the comparison between organic and conventional food production methods is not consensual regarding the nutritional superiority and health benefits of organic food (Barański et al., 2014; Dangour et al., 2010; Smith-Spangler et al., 2012; Williams, 2002). Nonetheless, individuals often infer proprieties that are unrelated to the production method, perceiving organic food more positively than conventional food. This belief seems to hold even when consumers are exposed to scientific evidence that refutes it (Olson, 2017). Besides influencing product evaluation, the organic claim seems to

impact judgments about the consumer of such products. For example, foregoing exercise is deemed more acceptable when a target person ate organic (vs. conventional) food (Prada, Rodrigues, & Garrido, 2016; Schuldt & Schwarz, 2010). The impact of the organic claim on product evaluation has been assessed across different evaluative dimensions, including sensory proprieties, nutritional judgments and value-related judgments. For example, when compared to conventional food, organic food is perceived as having better nutritional qualities (Lee, Shimizu, Kniffin, & Wansink, 2013; Sörqvist, Haga, Langeborg, et al., 2015), as safer to consume (Ellison, Duff, Wang, & White, 2016; Hoefkens, Verbeke, Aertsens, Mondelaers, & Van Camp, 2009), as environmentally friendly (Lazzarini, Zimmermann, Visschers, & Siegrist, 2016), and even as having more benefits for mental performance (Sörqvist, Haga, Langeborg, et al., 2015). Not surprisingly, consumers are willing to pay more for organic products (Lee et al., 2013; Sörqvist, Haga, Langeborg, et al., 2015; van Doorn & Verhoef, 2011; Wiedmann, Hennigs, Behrens, & Klarmann, 2014), and are more likely to recommend such products to others (e.g., Wiedmann et al., 2014). Research also shows that when an unfamiliar brand retails an organic (vs. conventional) product, both the attitude towards that brand and brand trust are enhanced (Ellison et al., 2016). This bias has been interpreted as reflecting a halo effect (i.e., the positive influence of a given positive attribute on other unrelated attributes; Thorndike, 1920; see also Schuldt & Schwarz, 2010).

The magnitude of the impact of the organic label on food perception depends on how such attribute is itself perceived. This implies that the halo effect is only likely to be observed in participants that believe on the advantage of organic food over conventional one (e.g., Sörqvist, Marsh, et al., 2016). This idea is supported by previous research suggesting that individuals with pro-environmental attitudes or

behaviors are more prone to such halo effect (e.g., Schuldt & Schwarz, 2010; Sörqvist, Langeborg, & Marsh, 2016, see also Holmgren, Kabanshi, & Sörqvist, 2017; Sörqvist, Haga, Holmgren, & Hansla, 2015), at least when certain evaluative dimensions are assessed. For example, participants who report more positive attitudes towards sustainable consumer behavior (e.g., those who buy eco-friendly products, or pre-separate waste at source) show a greater taste preference and willingness-to-pay for an "eco-friendly" (vs. conventional) product (Sörqvist et al., 2013), and judge the eco-friendly alternative more favorability across evaluative dimensions (e.g., health benefits; vitamin content; Sörqvist, Haga, Langeborg, et al., 2015). Schuldt and Hannahan (2013) have also shown that individuals with low environmental concerns expected organic food to taste worse than conventional food. However, they also found that ratings of perceived healthfulness were independent of environmental concerns. On the other hand, Lee et al. (2013) showed that the effect of an organic claim on perceived calories is weaker for individuals who often engage in pro-environmental activities, or buy this type of food more often.

The main goal of the current paper was to examine whether the impact of organic claims generalizes to different food types. Specifically, we examined the perception of whole and processed organic food products, by considering evaluations of food exemplars and general evaluations of both food types. The evaluations of organic food types were made by comparing them to their conventional counterparts in three dimensions – healthfulness, taste and caloric content. In addition to our primary goal, we also examined the role of individual variables – self-reported knowledge about organic food, frequency of consumption of organic food, and environmental concerns – that might be associated with these evaluations (e.g., Schuldt & Hannahan, 2013). Finally, we present normative ratings of food exemplars,

as they are likely to be useful to researchers investigating the impact of organic claims on product evaluation.

Organic Claims Bias on Healthfulness, Taste and Caloric Content Perception

The evaluative dimensions of healthfulness, taste, and caloric content have been used in the context of organic food (Schleenbecker & Hamm, 2013), as well as in other food judgment research, including normative ratings of food images (Blechert, Meule, Busch, & Ohla, 2014; Charbonnier, van Meer, van der Laan, Viergever, & Smeets, 2016; Foroni, Pergola, Argiris, & Rumiati, 2013). For instance, health and taste quality often emerge as the primary reasons for purchasing organic food (Hughner, McDonagh, Prothero, Shultz, & Stanton, 2007; Pearson, Henryks, & Jones, 2011; Schifferstein & Oude Ophuis, 1998).

Research has consistently shown that organic food is perceived as more *healthful* than conventional food. This effect is found both when individuals are judging the general organic food category (e.g., Schuldt & Hannahan, 2013), and when judging specific food exemplars (e.g., Lazzarini et al., 2016; Prada et al., 2016; Sörqvist, Haga, Langeborg, et al., 2015). Perceived healthfulness of a food product, in turn, influences food intake (e.g., Provencher, Polivy, & Herman, 2009).

Taste seems to override other organic food sensory proprieties such as appearance (for a review, see Hemmerling, Asioli, & Spiller, 2016). This dimension has often been assessed by having participants sampling a product (taste perception). Several studies comparing taste perception between organic and conventional foods (e.g., Annett, Muralidharan, Boxall, Cash, & Wismer, 2008; Ekelund, Fernqvist, & Tjärnemo, 2007; Kihlberg, Johansson, Langsrud, & Risvik, 2005; Poelman, Mojet, Lyon, & Sefa-Dedeh, 2008; Rousseau, 2015; Sörqvist, Haga, Langeborg, et al., 2015; Tobin, Moane, & Larkin, 2013) report inconsistent findings that do not seem to

support a general taste advantage for organic food (for a review, see Bourn & Prescott, 2002). In fact, results seem to depend on sampling conditions (Pagliarini, Laureati, & Gaeta, 2013), and on the type of product. For example, yogurt labeled as organic was considered more flavorful than the conventional one, whereas the opposite effect emerged for cookies (Lee et al., 2013); and organic orange juice was preferred over conventional one, but no differences emerged for milk (Fillion & Arazi, 2002).

In line with previous research, in the current studies the taste dimension is assessed without an actual sampling of the product, namely by asking participants to anticipate its taste (i.e., expected taste, see Fernqvist & Ekelund, 2014; Piqueras-Fiszman & Spence, 2015). For example, Schuldt and Hannahan (2013) included a general taste judgment about organic food (i.e., "compared to other foods, please rate how tasty organic foods tend to be") and found that organic food is perceived as less tasty than conventional food. Other authors, in contrast, did not find differences between organic and conventional food in the expected taste (e.g., Ellison et al., 2016; Loebnitz & Aschemann-Witzel, 2016).

Perceived caloric content constitutes a relevant food evaluative dimension that is strongly correlated with actual caloric content (Charbonnier et al., 2016; Foroni et al., 2013). Research comparing organic and conventional food have shown that individuals perceive organic food as having fewer calories than conventional food (e.g., Lee et al., 2013; Prada et al., 2016; Sörqvist, Haga, Langeborg, et al., 2015). For example, Schuldt and Schwarz (2010, Experiment 1) tested if an organic claim biased judgments of a real food product – Oreo cookies – by examining both conventional and organic versions ("Oreo cookies made with organic flour and sugar"). The organic (vs. conventional) version was perceived as less caloric and as more

appropriate to eat more often than other cookie brands, but only for individuals high on pro-environmentalism.

Healthfulness, taste and caloric content food ratings are not independent. For example, there is a negative association between healthfulness ratings and caloric content (Charbonnier et al., 2016). There is also evidence of a negative association between taste and healthfulness, which presumably reflects an "unhealthy = tasty" heuristic (e.g., Choi & Springston, 2014; Raghunathan, Naylor, & Hoyer, 2006; cf. Dubé, Fatemi, Lu, & Hertzer, 2016). Studies have also shown that more caloric food exemplars are rated as having less palatability (i.e., taste) than less caloric foods (Blechert et al., 2014).

From these findings, it is clear that the advantage of organic over conventional food is not necessarily consistent across evaluative dimensions. In our view, a potentially relevant variable to understand these mixed findings is the type of product under consideration.

Type of Product: Whole versus Processed Food

The impact of organic claims on food evaluation has been examined using a myriad of products. Some studies have focused on fruits and vegetables (e.g., Ekelund et al., 2007; Poelman et al., 2008; Sörqvist, Haga, Langeborg, et al., 2015), whereas others have examined both branded (e.g., Schuldt & Schwarz, 2010) or unbranded (e.g., Lee et al., 2013) processed foods. However, studies comparing different types of organic products are still scarce. Examining the type of product may help clarify contradictory findings, because some products may be more representative of the organic food category than others. For example, using a qualitative approach, Padel and Foster (2005) found that consumers' first association to organic was fruit and vegetables, and that this type of products are generally their first (and often the only)

experience with buying organic food (see also Pieniak, Aertsens, & Verbeke, 2010). Converging with this, fruits and vegetables constitute a large share of the organic market within the EU (Katsarova, 2015). Yet, demand for other products has been increasing, including animal products (dairy and meat), beverages (mainly wine, but also coffee and tea), desserts (e.g., ice-cream, cakes, etc.), and ready-to-eat meals (e.g., pizza, soup, etc.). The organic claim (along with "healthy") is also becoming increasingly popular in frozen processed food (International Markets Bureau, 2011a). Interestingly, the amount of processing of organic foods seems to be negatively associated with sales, suggesting that the nutritional benefits of consuming organic ingredients are somehow lost in processing (International Markets Bureau, 2011b).

The impact of organic claims on product evaluation may depend on its level of processing - that is, whole versus processed food. For example, Roininen, Arvola, and Lähteenmäki (2006) found that the words produced in association to organically produced food were less positive when the level of processing was higher. Szocs and Lefebvre (2016) showed that food that was mechanically processed (e.g., blended) was perceived as less healthful and higher in calories than food that did not undergo such change, even when its volume is hold constant. Overall, the more processing a product undergoes, the less natural it is perceived (Evans, de Challemaison, & Cox, 2010). When a food is described as natural, consumers are also likely to infer that it is organic (Berry, Burton, & Howlett, 2017). Organically farmed food is perceived as more natural than conventionally farmed food (Rozin, 2005), and individuals report preference for natural entities, particularly food (Rozin et al., 2004). This preference has implications for perceived healthfulness, such that processed products are perceived as more unhealthful (e.g., Dubé et al., 2016; Lazzarini et al., 2016). Normative data on food images also shows that the level of processing is strongly and

positively associated to perceived caloric content (e.g., Foroni et al., 2013), and that whole foods are perceived as more palatable and rated as more desirable to eat than processed foods (Blechert et al., 2014). The advantage of whole over processed food does not extend to all attributes. For example, although fresh fruits are rated as more healthful, nutritious and tastier than processed fruit (e.g., canned fruit, jam), processed fruits were rated as more affordable and more convenient (Sabbe, Verbeke, & Damme, 2008). In a recent study, Machiels and Karnal (2016) manipulated packaging design to convey distinct levels of processing and naturalness of the same processed food (orange juice). When the product was perceived as unprocessed, purchase intention increased, and this effect was mediated by perceived taste.

Some authors have already acknowledged the need to examine the impact of organic claims using different types of products. For instance, Arvola and colleagues (2008) selected one exemplar of both unprocessed (apples) and processed foods (ready-to-cook pizza), and tested an organic food purchase intention model. The authors argued that organic unprocessed foods (i.e., whole organic foods) are more familiar and that perceiving a high level of processing may be incongruent with the notion of organic food. To simply put it, if organic foods are construed as natural (Meyer-Höfer, Nitzko, & Spiller, 2015; Shepherd, Magnusson, & Sjödén, 2005), they should not be processed to a great extent. In another study, Dean, Raats and Sheperd (2012) tested the purchase intention of two comparable exemplars of whole (fresh tomatoes) and processed organic food (tomato sauce). Results showed that perceived behavioral control only predicts intention to buy the whole food, which was interpreted as a matter of higher perceived availability of organic fresh foods (see also Dean, Raats, & Shepherd, 2008). More recently, Ellison and colleagues (2016) found that the organic claim positively influenced expected taste ratings for the whole food

(strawberries), but not for the processed one (cookies). Conversely, the organic claim positively influenced healthfulness for the processed food, but not for the whole one. However, Sörqvist, Haga, Langeborg, and colleagues (2015) tested the impact of the organic claims on similar products (grapes and raisins) and found more favorable evaluations for the organic alternative, independently of food type. In another study, Rousseau (2015) found that consumer choice for chocolate was not influenced by the organic label, arguing that in the case of indulgent food, the association between organic and healthful is disrupted.

Overall, research seems to suggest that the advantage of organic over conventional food may be contingent on the type of food, and on the evaluative dimension under consideration. We examined these assumptions in two studies, by asking participants to evaluate images of food exemplars categorized as either whole or processed. All exemplars were described as organic and were evaluated by comparing them to their conventional alternative (following the procedure by Schuldt & Hannahan, 2013, Study 1). Participants evaluated exemplars in perceived healthfulness, taste and caloric content. We also assessed participants' general beliefs regarding whole and processed foods categories in these dimensions. Assessing both types of measures within-participants allows the direct comparison of their outcomes which may be relevant to understand previous inconsistent findings. For example, organic food was perceived as less tasty than conventional food when general measures were assessed (e.g., Schuldt & Hannahan, 2013), whereas no differences in expected taste emerged when assessing evaluations of exemplars (Ellison et al., 2016). Finally, we explored the role of individual differences, namely – self-reported knowledge about organic food, frequency of consumption of organic food and environmental concerns – in participants' assessments.

Study 1

In this study, we asked participants to evaluate 32 food images depicting whole and processed food exemplars. All exemplars were described as organic and were evaluated in comparison to their conventional alternative in three dimensions: perceived healthfulness, taste and caloric content. We additionally assessed overall evaluations of whole and processed food types also in these dimensions.

Method

Participants and Design

One-hundred-eighty-two Portuguese individuals volunteered to participate in this experiment (70.9% female, M_{age}= 29.65, *SD* = 8.70; 30.8% were students and 59.9% were employed; 76.2% had at least a college degree). Twenty-two participants reported having a non-conventional diet (e.g., vegetarian, vegan, macrobiotic, etc.) and were excluded from the initial sample (*N* = 204).

Participants evaluated their knowledge about organic food as moderate (*M* = 4.14, *SD* = 1.44), *t*(181) = 1.29, *p* = .200, *d* = 0.10, and indicated a moderate frequency of organic food consumption (*M* = 3.80, *SD* = 1.83), *t*(181) = -1.46, *p* = .146, *d* = 0.11 (*t* tests against the scale midpoint: 4).

The design included two factors manipulated within-participants: 2 (Food type: Whole foods; Processed foods) x 3 (Dimension: Healthfulness; Taste; Calories).

Materials

Images depicting food exemplars have been described as an alternative to real food when examining responses to visual food exposure (e.g., Charbonnier et al., 2016). Our stimulus set (*n* =32) was selected from a validated food picture database – Food.Pics (Blechert et al., 2014) that includes both subjective ratings and objective nutritional information. Half of the images depicted whole foods ($M_{valence}$ = 62.21, *SD*

= 7.39; $M_{palatability}$ = 64.88, *SD* = 8.71; $M_{actual\ calories}$ = 38.19, *SD* = 24.82), and included fruits (e.g., apples, strawberries, grapes) and vegetables (e.g., lettuce, zucchini, potatoes). The other half depicted processed foods ($M_{valence}$ = 51.73, *SD* = 6.35; $M_{palatability}$ = 55.99, *SD* = 7.93; $M_{actual\ calories}$ = 288.09, *SD* = 138.03), and included sweets (e.g., ice-cream, cake, muffin) and meals (e.g., pasta, sandwich, hamburger). All food exemplars were presented in color against a white background (image resolution: 600 × 450 pixels, sRGB color format; see Appendix A for the full description of the stimuli used).

Procedure and Measures

Individuals were invited (e.g., institutional email, social network websites) to collaborate on a Qualtrics web survey about the perception and evaluation of food images. By clicking on a hyperlink, individuals were directed to a secure webpage in which they were told that we were conducting a consumer psychology study aiming to explore how people evaluate different types of food products. They were also informed about the expected duration of the study (approximately 10 minutes).

Participants were told that in their particular case all the food products that would be presented were *organic*. They were further informed that their task was to evaluate each image of an organic food product by comparing it to its conventional counterpart in three dimensions: healthfulness (1 = *Less healthful that conventional* to 7 = *More healthful than conventional*); taste (1 = *Less tasty that conventional* to 7 = *More tasty than conventional*) and caloric content (1 = *Fewer calories that conventional* to 7 = *More calories than conventional*). Participants were asked to answer as quickly as possible, although there was no time limit to complete the task. They were also informed that there were no right or wrong answers, and that all data

would be treated anonymously. Participants provided consent to collaborate in the study by checking the “I agree” option.

Before starting their task, participants provided demographic information (age, gender, education level, occupation). Next, each participant completed 32 trials (i.e., the full set of stimuli) presented in random order. In each trial, the food image was presented on the top center of the screen. To emphasize that the product was organic, the sentence "This organic product is..." was presented below each image, followed by the three rating scales (in random order in each trial).

The general evaluations about both organic food types were assessed using the same set of three evaluative dimensions (presented in random order): "In my opinion, whole organic foods (e.g., fruits, vegetables, etc.) are...", and “In my opinion, processed organic foods (e.g., sweets, ready-to-eat meals, etc.) are...". These overall evaluations of each organic food type were presented in different pages.

We also assessed individual differences regarding participants’ self-reported knowledge about organic food ("How do you rate your knowledge about organic food?", 1 = *Very low*; 7 = *Very high*), and their frequency of organic food consumption ("How often do you eat organic food?", 1 = *Rarely*; 7 = *Frequently*). Additionally, we asked participants to complete the New Environmental Paradigm scale (NEP; Dunlap et al., 2000). This scale comprises 15 items about environmental concerns (e.g., “Humans are seriously abusing the environment”; 1 = *Strongly disagree*, 5 = *Strongly agree*) and presented good reliability in our study (α = .70).

Finally, participants were also asked about their diet (absence of "specific diet", macrobiotic, vegetarian, vegan, gluten free, other) and then they were thanked and debriefed.

Results and Discussion

First, we present the descriptive results regarding the evaluation of organic versus conventional foods. Second, we examine the impact of food type (whole vs. processed) on ratings of both exemplars and general evaluations in the three evaluative dimensions. These results are summarized in Table 1. Third, we present additional analysis examining associations with individual differences. Finally, we summarize the results of the normative ratings of food exemplars.

Evaluations of Organic versus Conventional Food

To examine differences in the evaluations of organic food versus conventional food, we compared mean ratings against the scale midpoint (a mean score of 4 in a given dimension indicates that a given organic food is equated to its conventional alternative).[1]

Exemplars. Mean ratings on each dimension were calculated for each food type by averaging the 16 whole foods exemplars and the 16 processed foods exemplars (see Table 1, Exemplars Evaluation columns).

Table 1

Exemplars and General Evaluation of Whole and Processed Organic Foods

	Exemplars Evaluations			*General Evaluations*			*Exemplars vs. General Evaluations*
	M	*SD*	*t*(181)[1]	*M*	*SD*	*t*(181)[1]	*t*(181)
Whole Foods							
Healthfulness	6.03[a]	0.98	28.05***	6.15[a]	1.36	21.37***	-1.38
Taste	5.62[a]	1.12	19.45***	5.72[a]	1.44	16.08***	-1.16
Calories (r)	4.82[a]	1.03	10.73***	4.87[a]	1.38	8.51***	< 1
Processed Foods							
Healthfulness	4.39[b]	1.42	3.75***	4.36[b]	2.03	2.41*	< 1
Taste	4.88[b]	1.03	11.50***	4.50[b]	1.51	4.47***	3.75***
Calories (r)	3.78[b]	1.19	-2.51*	3.84[b]	1.61	-1.34	< 1

[1] Because higher scores on the calories dimension represented a negative evaluation of the food items (i.e., more calories than their conventional counterparts), ratings for this dimension were reversed, so that higher scores indicate fewer calories than the conventional counterparts. By doing so, higher scores in all dimension indicate more positive evaluations of each food type.

$^{***}p \leq .001$. $^{*}p \leq .050$.

Note. [1]Value for *t* test = 4 (scale midpoint). (r) = reversed rating (i.e., higher ratings indicate fewer calories). Different superscripts (^{a,b}) indicate differences between whole and processed organic food for each dimension (exemplars and general evaluations separately).

Participants evaluated the exemplars of both whole and processed organic food as more healthful and tastier than their conventional alternative, all $p < .001$. Whereas whole organic foods were perceived as having fewer calories than conventional alternatives, $p < .001$, processed organic foods were perceived as having more calories than conventional foods, $p = .013$.

General Evaluations. The general pattern of findings for the general evaluations replicated that of the evaluation of the exemplars. Whole and processed organic foods were perceived as more healthful and tastier than their conventional counterparts, all $p < .017$. Whole organic foods were evaluated as having fewer calories than whole conventional foods, $p < .001$, whereas processed organic foods were seen as equally caloric as their conventional option, $p = .182$ (see Table 1, General Evaluation columns).

Overall, the organic nature of both whole and processed foods was perceived as advantageous in healthfulness and taste, for both exemplars and general evaluations. A similar advantage was observed for calories, but only for whole foods.

Evaluations of Whole and Processed Organic Food

Exemplars. Results showed that the advantage of organic food over conventional food in healthfulness, $t(181) = 15.09$, $p < .001$, $d = 1.12$, taste, $t(181) = 9.18$, $p < .001$, $d = 0.68$, and calories, $t(181) = 8.25$, $p < .001$, $d = 0.61$, was more prominent for whole, than for processed food exemplars (see Table 1).

General Evaluations. As observed for food exemplars, results showed that the advantage of organic food over conventional food in healthfulness, $t(181) = 10.68$, p

< .001, d = 0.79, taste, $t(181) = 9.14$, $p < .001$, d = 0.68, and calories, $t(181) = 6.43$, $p < .001$, d = 0.48, was more prominent for whole than for processed food (see Table 1).

Additional Analyses

To further examine if the advantage of organic foods was associated with individual differences, we explored the role of participants' self-reported knowledge about organic food and the frequency of their organic food consumption, as well as their environmental concern (see Schuldt & Hannahan, 2013) in the reported evaluations (for each dimension and food type). Table 2 presents the correlations between the variables.

Table 2

Correlations Between Organic Self-Reported Knowledge, Organic Frequency Consumption, Environmental Concern, Whole and Processed Exemplars and General Evaluations

	1	2	3	4	5	6	7	8	9
1. Knowledge	-	.59***	.02	.09	.20**	.03	.08	.06	-.07
2. Consumption	.59***	-	.01	-.07	.20**	-.10	.00	.12	-.11
3. Environmental Concerns	.02	.01	-	-.04	.15*	-.15	-.01	-.01	-.05
4. Exemplars: Healthfulness	.16*	.18*	.28***	-	.12	.70***	.44***	.11	.21**
5. Exemplars: Taste	.24***	.23**	.21**	.78***	-	-.32***	.00	.47***	-.25***
6. Exemplars: Calories (r)	.14	.14	.04	.20**	.05	-	.24***	-.20**	.35***
7. General: Healthfulness	.13	.16*	.17*	.56***	.45***	.04	-	.29***	.61***
8. General: Taste	.37***	.36***	.21**	.52***	.62***	.06	.58***	-	-.01
9. General: Calories (r)	.11	.04	.02	.13	.11	.55***	.19*	.12	-

*** $p \leq .001$. ** $p \leq .010$. * $p \leq .050$.

Note. (r) = reversed rating (i.e., higher ratings indicate fewer calories). Correlations for whole foods appear below the diagonal, and correlations for processed foods appear above the diagonal.

Self-reported knowledge about organic food was positively correlated with frequency of consumption of organic food. For whole foods, these two variables, as

well as environmental concerns, were positively associated with taste ratings of both exemplars and general evaluations. In addition, environmental concerns were positively associated with healthfulness ratings. For processed foods, self-reported knowledge and frequency of consumption were positively associated with taste ratings of exemplars, although to a weaker extent. Overall, the results suggest that individual differences are associated with perceived advantages of organic food over their conventional alternatives, especially for whole foods.

Regarding the association between evaluative dimensions, for whole foods taste and healthfulness were always positively associated, regardless of being exemplars or general evaluations. For processed foods, healthfulness was positively associated with calories for both exemplars and general evaluations, that is, the fewer the perceived calories, the higher the healthfulness ratings. Moreover, there was a negative association between calories and taste, but only for exemplars, that is, exemplars perceived as having more calories were rated higher in taste. Taste and healthfulness were only positively associated for general evaluations.

Interestingly, ratings in the same evaluative dimension were correlated in both exemplars and general evaluations, for both whole and processed foods suggesting some convergence between both measures.

Normative Ratings

We also present descriptive results by food exemplar according to the three evaluative dimensions (see Appendix A). Based on the confidence intervals, organic exemplars were categorized as “less”, “equal” or “more” than conventional ones in each dimension (Garrido et al., 2016; Prada, Rodrigues, Silva, & Garrido, 2016).[2]

[2] When categorized as equal in a given dimension, organic food exemplars were perceived as similar to their conventional counterparts. When categorized as less (vs. more), organic food exemplars were perceived as less (vs. more) healthful, as less (vs. more) tasty, and as having less (vs. more) calories than conventional ones.

The entire set of whole organic food exemplars was categorized as more healthful and tastier than their conventional counterparts. The majority of these exemplars were also perceived as having fewer calories (87.5%) than their conventional alternatives. The only exceptions were two food items perceived as equally caloric when compared to their conventional alternatives (12.5%; i.e., bananas and potatoes). All processed organic foods were perceived as tastier, and either equally (56.3%; e.g., croissants) or more healthful (43.8%; e.g., spaghetti with tomato sauce) than their conventional equivalents. Half of these food items were perceived as more caloric (50.0%; e.g., hamburger), whereas the remaining were rated as equally (37.5%; e.g., ham sandwich) or less caloric (12.5%; e.g., muesli bar), than their conventional counterparts.

In short, the results from Study 1 indicated that organic food exemplars - both whole and processed - were judged as healthier and tastier than their conventional counterparts. Whole organic food exemplars were perceived as less caloric, whereas the processed exemplars were perceived as more caloric than the conventional alternatives. General evaluations of healthfulness, taste and calories of both organic food types replicated these findings. Taken together, our results suggest a more positive impact of the organic claim for whole (vs. processed foods) and that the perceived advantage of this type of foods over conventional ones is associated to individuals' self-reported knowledge, frequency of consumption and environmental concerns.

However, the stimuli set in the current study was not optimal given that whole foods included exclusively exemplars of fruits and vegetables, whereas processed foods included mostly exemplars based on other ingredients (e.g., meat and grain-based food). Therefore, the difference between subsets was not solely the whole

versus processed nature of the exemplars, but overlapped with the food categories represented.

Study 2

The primary goal of the current study was to replicate Study 1 by using stimuli that are more varied and balanced throughout food types. Specifically, the subset of whole foods now also includes exemplars such as meat or fish, and the processed foods subset includes exemplars that are fruit or vegetable-based. Besides expanding the variety and number of food exemplars (60 vs. 32 as in Study 1), the new stimulus set always depicts packaged food products to ensure that the most salient difference between sets is their whole or processed nature.

Method

Participants and Design

Seventy-six Portuguese undergraduate students volunteered to participate in this experiment (80.3% female; M_{age}= 20.04, SD = 3.03) in exchange for partial course credit. Nine participants reporting having a non-conventional diet were excluded from the initial sample (N = 85).

Participants evaluated their knowledge about organic food as moderate (M = 3.68, SD = 1.48), $t(75) = -1.86$, $p = .067$, $d = .21$, and reported a moderate frequency of consumption of this type of food (M = 3.63, SD = 1.66), $t(75) = -1.93$, $p = .057$, $d = 0.22$ (t tests against the scale midpoint: 4).

The design included two factors manipulated within-participants: 2 (Food type: Whole foods; Processed foods) x 3 (Dimension: Healthfulness; Taste; Calories).

Materials

The food images (n = 60) were selected from the webpage of an international grocery retailer that included nutritional information. A panel of three judges

discussed and agreed on the familiarity of the food product depicted in each image. All branding and nutritional information labels were removed using Photoshop, but the original product identification was kept (e.g., "chocolate chip muffins"). Half of the images depicted packaged whole foods ($M_{actual\ calories}$ = 78.50, *SD* = 62.37) and included fruits (e.g., apples, grapes, *n* = 10), vegetables (e.g., lettuce, potatoes, *n* = 10), and fish and meat (e.g., salmon fillets, raw pork steaks, *n* = 10). The fruit and vegetables subsets matched the products used in Study 1 (four new products were added). The remaining images depicted packaged processed foods ($M_{actual\ calories}$ = 191.23, *SD* = 102.71) and included sweets (e.g., ice-cream, cake, *n* = 10) and meals (e.g., frozen pasta, pizza, *n* = 10). When selecting meal exemplars, we aimed to systematically vary the assortment, by including vegetable- and meat-based options (e.g., "vegetable lasagna" and "cheese and tomato pasta", as well as "beef lasagna" and "cheese and bacon pasta"). Likewise, the assortment of sweets also included fruit-based options (e.g., "strawberry sundae" and “lemon sorbet”). A new subset of processed foods was added to match the type of items included in the whole foods categories - i.e., fruits, vegetables and meat/fish (e.g., canned fruit, canned vegetable soup and canned tuna, *n* = 10). All food items were presented in color against a white background (540 × 540 pixels, see Appendix B for the full description of the stimuli used).

Procedure and Measures

Participants were invited to the psychology laboratory to collaborate on a survey about perception and evaluation of food (using Qualtrics). Informed consent, instructions and measures were identical to Study 1, with the exception of the number of trials (60 in Study 2). Each session took on average 15 minutes.

Results and Discussion

Data were analyzed as in Study 1: evaluation of organic versus conventional foods; impact of food type on ratings of both exemplars and general evaluations in the three evaluative dimensions; additional analysis examining whether the evaluation of organic foods was associated with individual differences; and normative ratings of food exemplars.

Evaluations of Organic versus Conventional Food

Exemplars. Mean ratings on each dimension were calculated for each food type (i.e., average of 30 whole foods and 30 processed foods exemplars). As in Study 1, higher scores correspond to more positive evaluations in the three dimensions (i.e., more healthfulness, tastier and fewer calories) and the advantage of organic food over conventional food was assessed by comparing mean ratings against the scale midpoint (see Table 3, Exemplars Evaluation columns).

Table 3

Exemplars and General Evaluation of Whole and Processed Organic Foods

	Exemplars Evaluations			*General Evaluations*			*Exemplars vs. General Evaluations*
	M	*SD*	$t(75)^1$	*M*	*SD*	$t(75)^1$	$t(75)$
Whole Foods							
Healthfulness	5.57^a	1.01	13.55^{***}	6.01^a	1.06	16.49^{***}	-3.44^{***}
Taste	5.19^a	0.99	10.46^{***}	5.49^a	1.37	9.45^{***}	-1.92
Calories (r)	4.70^a	0.86	7.07^{***}	4.95^a	1.18	7.02^{***}	-2.21^{*}
Processed Foods							
Healthfulness	3.99^b	1.38	-0.05	3.95^b	1.74	-0.26	< 1
Taste	4.70^b	0.87	6.99^{***}	4.26^b	1.54	1.49	2.67^{**}
Calories (r)	3.64^b	1.19	-2.67^{**}	3.53^b	1.44	-2.87^{***}	< 1

$^{***}p \leq .001$. $^{**}p \leq .010$. $^{*}p \leq .050$.

Note. [1]Value for *t* test = 4 (scale midpoint). (r) = reversed rating (i.e., higher ratings indicate fewer calories). Different superscripts (^{a,b}) indicate differences between whole and processed organic food for each dimension (exemplars and general evaluations separately).

Similar to Study 1, participants evaluated the exemplars of whole organic foods as more healthful, as tastier and as having fewer calories than their conventional

counterparts, all $p < .001$. However, for processed food the only advantage of organic over conventional food occurred at the taste level, $p < .001$. Processed organic exemplars were rated as having more calories than their conventional alternatives, $p = .009$, and as equally healthful, $t < 1$.

General Evaluations. The pattern found for general evaluations of whole organic foods replicates results from Study 1, i.e., more healthful, tastier and less caloric than their conventional counterparts, all $p < .001$. Processed organic foods were rated as being as healthful and tasty as conventional food, both $p > .141$, and as having higher caloric content, $p = .005$ (see Table 3, General Evaluation columns).

Evaluations of Whole and Processed Organic Food

Exemplars. Results showed that the advantage of organic food over conventional food in healthfulness, $t(75) = 9.79$, $p < .001$, $d = 1.12$, taste, $t(75) = 4.27$, $p < .001$, $d = 0.49$, and calories, $t(75) = 6.21$, $p < .001$, $d = .71$, was more prominent in whole than in processed food (see Table 3).

General Evaluations. Results showed again that the advantage of organic over conventional food in healthfulness, $t(75) = 9.28$, $p < .001$, $d = 1.06$, taste, $t(75) = 5.59$, $p < .001$, $d = 0.64$, and calories $t(75) = 6.23$, $p < .001$, $d = 0.71$, was more prominent in whole than in processed food (see Table 3).

Additional Analyses

As in Study 1, we examined the associations between individual variables and in the reported evaluations (for each dimension and food type, see Table 4).

Table 4

Correlations Between Organic Self-Reported Knowledge, Organic Frequency Consumption, Environmental Concern, Whole and Processed Exemplars and General Indexes

	1	2	3	4	5	6	7	8	9
1. Knowledge	-	.51***	-.11	.04	.22	-.07	-.14	.04	-.17
2. Consumption	.51***	-	-.05	-.04	.08	-.07	.02	.25*	-.04
3. Environmental Concerns	-.11	-.05	-	-.25*	.03	-.17	.09	.22	-.11
4. Exemplars: Healthfulness	.32**	.25*	.08	-	-.12	.92***	.46***	.00	.59***
5. Exemplars: Taste	.29**	.22	.09	.84***	-	-.22	-.14	.41**	-.14
6. Exemplars: Calories (r)	.09	.14	.27*	.58***	.35**	-	.53***	.07	.67***
7. General: Healthfulness	.24*	.12	.25*	.43***	.38***	.22	-	.32**	.69***
8. General: Taste	.27*	.31**	.11	.36***	.38***	.06	.49***	-	.06
9. General: Calories (r)	-.02	.01	.27*	.17	.02	.56***	.27**	-.03	-

*** $p \leq .001$. ** $p \leq .010$. * $p \leq .050$.

Note. (r) = reversed rating (i.e., higher ratings indicate fewer calories). Correlations for whole foods appear below the diagonal, and correlations for processed foods appear above the diagonal.

Self-reported knowledge about organic food was positively correlated with frequency of consumption of organic food. For whole foods, self-reported knowledge was also positively associated with healthfulness and taste ratings of both exemplars and general evaluations, whereas frequency of consumption was positively associated with healthfulness ratings of exemplars, and with general taste ratings. Environmental concerns were positively associated with calories ratings of both exemplars and general evaluations, and with general healthfulness evaluations.

Regarding the association between individual differences and ratings of processed foods, results only show a positive association between frequency of consumption and general taste ratings, and a negative association between environmental concerns and healthfulness ratings of exemplars (i.e., participants with higher environmental concerns perceived the exemplars as less healthful).

Within evaluative dimensions, for whole foods healthfulness and taste were always positively associated, as well as healthfulness and calories, for both exemplars and general evaluations. A positive association between taste and calories was only found for exemplars, such that foods rated as lower the calories were rated as higher

in taste. For processed foods, healthfulness and taste were only positively associated for general evaluations, and healthfulness and calories were positively associated for both exemplars and general evaluations.

As in Study 1, ratings in the same evaluative dimension were correlated in both exemplars and general evaluations, for both whole and processed foods suggesting some convergence between measures.

Normative Ratings

The pattern regarding whole foods was similar to Study 1, such that all exemplars were categorized as more healthful and as tastier than conventional food (see Appendix B). The majority of whole organic foods was also perceived as having fewer calories than the conventional alternative (86.7%). Processed organic foods were categorized as equally (66.7%; e.g., boxed chicken wrap) or more healthful (30.0%; e.g., strawberry jam) than their conventional alternative. These food items were also categorized as tastier (90.0%; chocolate chip muffins), and the remaining (e.g., instant mashed potatoes) as equally tasty to conventional ones. Processed organic food exemplars were categorized as equally (46.7%; e.g., canned tropical fruit salad) or as higher in calories (46.7%; chilled pepperoni pizza) than conventional alternatives. The exceptions were two exemplars categorized as having fewer calories (i.e., canned mashed peas and lemon sorbet).

General Discussion

Claims presented on food labels - such as “organic” - influence how consumers perceive and behave towards a given food product (for a review, see Fernqvist & Ekelund, 2014). Several studies have shown that people generally perceive organic food as superior to food produced according to conventional methods. Given that consumers describe processed products as containing additives

and other artificial ingredients, as having lower nutritional quality and as unhealthful (Ares et al., 2016), a high level of food processing seems to be incongruent with the idea of organic food (e.g., Arvola et al., 2008). In this research, we investigated whether the organic food advantage (vs. conventional food) generalizes across whole and processed food types. Specifically, we examined the perceived healthfulness, taste and caloric content of organic (vs. conventional) whole and processed food, using exemplars and general evaluations.

Results from two studies consistently showed that whole organic foods are perceived as more healthful, tastier and as having lower caloric content than their conventional counterparts. This is the case for both evaluations of food exemplars and general evaluations of whole organic foods. These findings are consistent with a halo effect (Thorndike, 1920) that has been reported in the context of food evaluation (for a review, see Chandon & Wansink, 2007). Specifically, based on the organic attribute, individuals infer other proprieties of the food product (e.g., Schuldt & Schwarz, 2010). In our studies, this halo effect was systematically observed with two different measures (exemplars and general evaluations) and across all the evaluative dimensions examined. Results regarding perceived caloric content are noteworthy, considering that the whole food exemplars were objectively low in calories, which could have constrained the impact of the organic claim. Moreover, our results suggest that the perceived advantage of whole (vs. processed) organic food seems to be more pronounced among individuals that report to be more knowledgeable about organic food, consume organic food more frequently and are more environmentally concerned.

The advantage of the organic claim for processed foods is less clear. Overall, organic (vs. conventional) processed foods were perceived as tastier, as more (Study

1) or equally healthful (Study 2), but as more caloric than conventional alternatives. The few studies examining the impact of organic claims according to food type do not report systematic effects across evaluative dimensions. For example, Ellison and colleagues (2015) reported the impact of the organic claim on taste evaluations for a whole food product (but not for a processed food product), and on healthfulness evaluations for a processed food product (but not for a whole food product). However, in that study only a single exemplar of each food type was used (strawberries and cookies), whereas in our studies we included a broader set of exemplars (16 or 30 exemplars of each food type). Nonetheless, in our studies, the organic claim was introduced simply by referring to the food products as organic. This generic claim is usually applied to whole foods, but not to processed foods. It is possible that the claim needs to be more specific in the case of processed foods, for instance focusing on the production method of the ingredients they include. For example, in Schuldt and Schwarz's (2010) study, Oreo cookies were not described as fully organic, but rather as made with organic flour and organic sugar. Future studies should explore this possibility.

The impact of the organic claim for whole foods seems to be robust. Therefore, we think it is worthwhile to further explore which features of processed food modulate the impact of such claim. In comparison to whole organic foods, processed organic foods are less available, less familiar and less prototypical of the organic food category. Previous studies focusing on the influence of the organic claim on processed food exemplars (yogurt, cookies and potato chips), suggest that the effect may depend on the specifics of the product and on the evaluative dimensions at stake (e.g., Lee et al., 2013). In our view, these differences may be related to the extent of product processing, namely weaker effects of the organic claim may occur

for highly processed products. The discrepancies found in the evaluations of processed foods between our two studies seem to support this idea. A main difference between our studies is that in Study 2 all food products were packaged. Packaging may be perceived as counteracting the sustainable nature of organic products, and thus have a detrimental impact on consumer choice, at least for organic fruits and vegetables (van Herpen, Immink, & van den Puttelaar, 2016, Study 1). In our studies, packaging did not seem to affect the evaluation of whole foods (e.g., presenting apples in a plastic bag did not change how apples were perceived in terms of healthfulness, taste and caloric content). Still, for processed food exemplars, packaging may have increased the perception of their level of processing. For example, in Study 1 a pasta dish was presented on a plate, whereas Study 2 presented a box of a frozen pasta meal. Therefore, it is possible that participants perceived the latter as more processed than the former, and were less likely to be influenced by the organic claim.

In future studies, instead of using a dichotomous categorization of food type (whole vs. processed; Blechert et al., 2014), it would be interesting to measure (e.g., Berry et al., 2017; Mouta, de Sá, Menezes, & Melo, 2016) or manipulate the extent to which food products are processed. For example, some products are likely to be perceived as "totally processed" (pizza) whereas other are just "partially processed" (tomato sauce, Dean et al., 2008). Even when keeping the product constant (pizza), it is possible to manipulate the degree of processing (e.g., frozen pizza to be baked at home vs. a ready-to-eat pizza supplied by a delivery service, Thogersen & Bredahl, 2006). The degree of processing can also be manipulated through visual or textual cues displayed in food packaging (e.g., Machiels & Karnal, 2016). Another possibility is to use food classification systems, such as the one proposed by Monteiro and

colleagues (2010), in which food products range from unprocessed or minimally processed (e.g., pasteurization and wrapping to preserve or increase food accessibility, such as milk and fresh meat), to ultra-processed (e.g., ready to eat products with little or no preparation, such as desserts and frozen meals). Alternatively, considering that individuals hold expectations regarding the naturalness of different product types (Smith, Barratt, & Selsøe, 2015), researchers can use stimuli (e.g., images of food) pre-tested regarding their perceived level of transformation (see Foroni et al., 2013). Moreover, future studies could also assess beliefs regarding whole and processed foods (e.g., European Food Information Council, 2016), as well as regarding organic food, and examine if such individual differences modulate the impact of the food production claims. It would also be interesting to replicate our work manipulating food type between-participants, to make the comparison between whole and processed foods less salient. Doing so would discard the potential contribution of task demands to the current findings.

The main contribution of our work relates to the systematic examination of the role played by food type on organic food evaluation. Overall, our findings show that the perceived advantages of organic over conventional food are stronger for whole than for processed foods, and are more prominent in individuals that report being more knowledgeable, consume organic food more often, and are environmentally concerned. By providing subjective norms of a diverse set of food exemplars, the current work also offers practical implications for researchers interested in investigating the impact of organic claims on food perception and behavior. From a marketing standpoint, and according to our data, it seems that the organic claim for processed foods may not be particularly advantageous in promoting positive inferences about the product. In the case of whole foods, however, the organic claim

may lead consumers to infer positive proprieties unrelated with the food production method. In other words, the organic claim may serve as an extra cue for a more positive perception (and, hopefully, choice) of products such as fruits and vegetables.

References

Annett, L. E., Muralidharan, V., Boxall, P. C., Cash, S. B., & Wismer, W. V. (2008). Influence of health and environmental information on hedonic evaluation of organic and conventional bread. *Journal of Food Science*, *73*, H50–H57. doi:10.1111/j.1750-3841.2008.00723.x

Ares, G., Vidal, L., Allegue, G., Giménez, A., Bandeira, E., Moratorio, X., … Curutchet, M. R. (2016). Consumers' conceptualization of ultra-processed foods. *Appetite*, *105*, 611–617. doi:10.1016/j.appet.2016.06.028

Arvola, A., Vassallo, M., Dean, M., Lampila, P., Saba, A., Lähteenmäki, L., & Shepherd, R. (2008). Predicting intentions to purchase organic food: The role of affective and moral attitudes in the Theory of Planned Behaviour. *Appetite*, *50*, 443–454. doi:10.1016/j.appet.2007.09.010

Barański, M., Srednicka-Tober, D., Volakakis, N., Seal, C., Sanderson, R., Stewart, G. B., … Leifert, C. (2014). Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses. *The British Journal of Nutrition*, *112*, 794–811. doi:10.1017/S0007114514001366

Berry, C., Burton, S., & Howlett, E. (2017). It's only natural: the mediating impact of consumers' attribute inferences on the relationships between product claims, perceived product healthfulness, and purchase intentions. *Journal of the*

Academy of Marketing Science. Advance online publication. doi:10.1007/s11747-016-0511-8

Blechert, J., Meule, A., Busch, N. A., & Ohla, K. (2014). Food-pics: An image database for experimental research on eating and appetite. *Frontiers in Psychology*, *5*, 617. doi:10.3389/fpsyg.2014.00617

Bourn, D., & Prescott, J. (2002). A comparison of the nutritional value, sensory qualities, and food safety of organically and conventionally produced foods. *Critical Reviews in Food Science and Nutrition*, *42*, 1–34. doi:10.1080/10408690290825439

Chandon, P., & Wansink, B. (2007). The biasing health halos of fast-food restaurant health claims: Lower calorie estimates and higher side-dish consumption intentions. *Journal of Consumer Research*, *34*, 301–314. doi:10.1086/519499

Charbonnier, L., van Meer, F., van der Laan, L. N., Viergever, M. A., & Smeets, P. A. M. (2016). Standardized Food Images: A photographing protocol and image database. *Appetite*, *96*, 166–173. doi:10.1016/j.appet.2015.08.041

Choi, H., & Springston, J. K. (2014). How to use health and nutrition–related claims correctly on food advertising: Comparison of benefit-seeking, risk-avoidance, and taste appeals on different food categories. *Journal of Health Communication*, *19*, 1047–1063. doi:10.1080/10810730.2013.872723

Dangour, A. D., Lock, K., Hayter, A., Aikenhead, A., Allen, E., & Uauy, R. (2010). Nutrition-related health effects of organic foods: A systematic review. *The American Journal of Clinical Nutrition*, *92*, 203–210. doi:10.3945/ajcn.2010.29269

Dean, M., Raats, M. M., & Shepherd, R. (2008). Moral concerns and consumer choice of fresh and processed organic foods. *Journal of Applied Social Psychology*, *38*, 2088–2107. doi:10.1111/j.1559-1816.2008.00382.x

Dean, M., Raats, M. M., & Shepherd, R. (2012). The role of self-identity, past behavior, and their interaction in predicting intention to purchase fresh and processed organic food. *Journal of Applied Social Psychology*, *42*, 669–688. doi:10.1111/j.1559-1816.2011.00796.x

Dubé, L., Fatemi, H., Lu, J., & Hertzer, C. (2016). The healthier the tastier? USA–India comparison studies on consumer perception of a nutritious agricultural product at different food processing levels. *Frontiers in Public Health*, *4*, 6. doi:10.3389/fpubh.2016.00006

Ebneter, D. S., Latner, J. D., & Nigg, C. R. (2013). Is less always more? The effects of low-fat labeling and caloric information on food intake, calorie estimates, taste preference, and health attributions. *Appetite*, *68*, 92–97. doi:10.1016/j.appet.2013.04.023

Ekelund, L., Fernqvist, F., & Tjärnemo, H. (2007). Consumer preferences for domestic and organically labelled vegetables in Sweden. *Acta Agriculturae Scandinavica*, *4*, 229–236. doi:10.1080/16507540701800665

Ellison, B., Duff, B. R. L., Wang, Z., & White, T. B. (2016). Putting the organic label in context: Examining the interactions between the organic label, product type, and retail outlet. *Food Quality and Preference*, *49*, 140–150. doi:10.1016/j.foodqual.2015.11.013

European Food Information Council (2016). *Understanding perceptions of processed food among UK consumers: A qualitative consumer study by EUFIC*. EUFIC

Forum n° 7. Retrieved from www.eufic.org/en/collaboration/article/eufic-forum-n-7-understanding-perceptions-of-processed-food-among-uk-consum

Evans, G., de Challemaison, B., & Cox, D. N. (2010). Consumers' ratings of the natural and unnatural qualities of foods. *Appetite*, *54*, 557–563. doi:10.1016/j.appet.2010.02.014

Fernqvist, F., & Ekelund, L. (2014). Credence and the effect on consumer liking of food – A review. *Food Quality and Preference*, *32*, 340–353. doi:10.1016/j.foodqual.2013.10.005

Fillion, L., & Arazi, S. (2002). Does organic food taste better? A claim substantiation approach. *Nutrition & Food Science*, *32*, 153–157. doi:10.1108/00346650210436262

Foroni, F., Pergola, G., Argiris, G., & Rumiati, R. I. (2013). The FoodCast research image database (FRIDa). *Frontiers in Human Neuroscience*, *7*, 51. doi:10.3389/fnhum.2013.00051

Garrido, M. V., Lopes, D., Prada, M., Rodrigues, D., Jerónimo, R., & Mourão, R. P. (2016). The many faces of a face: Comparing stills and videos of facial expressions in eight dimensions (SAVE database). *Behavior Research Methods*. Advance online publication. doi:10.3758/s13428-016-0790-5

Hemmerling, S., Asioli, D., & Spiller, A. (2016). Core organic taste: Preferences for naturalness-related sensory attributes of organic food among European consumers. *Journal of Food Products Marketing*, *22*, 824–850.

Hoefkens, C., Verbeke, W., Aertsens, J., Mondelaers, K., & Van Camp, J. (2009). The nutritional and toxicological value of organic vegetables: Consumer perception versus scientific evidence. *British Food Journal*, *111*, 1062–1077.

Holmgren, M., Kabanshi, A., & Sörqvist, P. (2017). Occupant perception of "green" buildings: Distinguishing physical and psychological factors. *Building and Environment*, *114*, 140–147. doi:10.1016/j.buildenv.2016.12.017

Hughner, R. S., McDonagh, P., Prothero, A., Shultz, C. J., & Stanton, J. (2007). Who are organic food consumers? A compilation and review of why people purchase organic food. *Journal of Consumer Behaviour*, *6*, 94–110. doi:10.1002/cb.210

International Markets Bureau. (2011a). *Frozen processed food in Western Europe*. Ottawa, CAN: Agriculture and Agri-Food Canada. Retrieved from http://publications.gc.ca/collections/collection_2012/agr/A74-1-38-2011-eng.pdf

International Markets Bureau. (2011b). *Organic packaged food and beverages in the United States*. Ottawa, CAN: Agriculture and Agri-Food Canada. Retrieved from http://publications.gc.ca/collections/collection_2012/agr/A74-1-36-2011-eng.pdf

Katsarova, I. (2015). *Organic food: Helping EU consumers make an informed choice*. Brussels, BE: European Parliamentary Research Service, European Parliament. Retrieved from http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/557009/EPRS_BRI(2015)557009_EN.pdf

Kihlberg, I., Johansson, L., Langsrud, Ø., & Risvik, E. (2005). Effects of information on liking of bread. *Food Quality and Preference*, *16*, 25–35.

Labiner-Wolfe, J., Jordan Lin, C.-T., & Verrill, L. (2010). Effect of low-carbohydrate claims on consumer perceptions about food products' healthfulness and

helpfulness for weight management. *Journal of Nutrition Education and Behavior*, *42*, 315–320. doi:10.1016/j.jneb.2009.08.002

Lazzarini, G. A., Zimmermann, J., Visschers, V. H. M., & Siegrist, M. (2016). Does environmental friendliness equal healthiness? Swiss consumers' perception of protein products. *Appetite*, *105*, 663–673. doi:10.1016/j.appet.2016.06.038

Lee, W. J., Shimizu, M., Kniffin, K. M., & Wansink, B. (2013). You taste what you see: Do organic labels bias taste perceptions? *Food Quality and Preference*, *29*, 33–39. doi:10.1016/j.foodqual.2013.01.010

Loebnitz, N., & Aschemann-Witzel, J. (2016). Communicating organic food quality in China: Consumer perceptions of organic products and the effect of environmental value priming. *Food Quality and Preference*, *50*, 102–108. doi:10.1016/j.foodqual.2016.02.003

Machiels, C. J. A., & Karnal, N. (2016). See how tasty it is? Effects of symbolic cues on product evaluation and taste. *Food Quality and Preference*, *52*, 195–202. doi:10.1016/j.foodqual.2016.04.014

Meyer-Höfer, M. von, Nitzko, S., & Spiller, A. (2015). Is there an expectation gap? Consumers' expectations towards organic: An exploratory survey in mature and emerging European organic food markets. *British Food Journal*, *117*, 1527–1546. doi:10.1108/BFJ-07-2014-0252

Monteiro, C. A., Levy, R. B., Claro, R. M., Castro, I. R. R. de, & Cannon, G. (2010). A new classification of foods based on the extent and purpose of their processing. *Cadernos De Saúde Pública*, *26*, 2039–2049.

Mouta, J. S., de Sá, N. C., Menezes, E., & Melo, L. (2016). Effect of institutional sensory test location and consumer attitudes on acceptance of foods and

beverages having different levels of processing. *Food Quality & Preference*, *48*, 262–267. doi:10.1016/j.foodqual.2015.10.002

Olson, E. L. (2017). The rationalization and persistence of organic food beliefs in the face of contrary evidence. *Journal of Cleaner Production*, *140*, 1007–1013. doi:10.1016/j.jclepro.2016.06.005

Padel, S., & Foster, C. (2005). Exploring the gap between attitudes and behaviour: Understanding why consumers buy or do not buy organic food. *British Food Journal*, *107*, 606–625. doi:10.1108/00070700510611002

Pagliarini, E., Laureati, M., & Gaeta, D. (2013). Sensory descriptors, hedonic perception and consumer's attitudes to Sangiovese red wine deriving from organically and conventionally grown grapes. *Frontiers in Psychology*, *4*, 896. doi:10.3389/fpsyg.2013.00896

Pearson, D., Henryks, J., & Jones, H. (2011). Organic food: What we know (and do not know) about consumers. *Renewable Agriculture & Food Systems*, *26*, 171–177. doi:10.1017/S1742170510000499

Pieniak, Z., Aertsens, J., & Verbeke, W. (2010). Subjective and objective knowledge as determinants of organic vegetables consumption. *Food Quality and Preference*, *21*, 581–588. doi:10.1016/j.foodqual.2010.03.004

Piqueras-Fiszman, B., & Spence, C. (2015). Sensory expectations based on product-extrinsic food cues: An interdisciplinary review of the empirical evidence and theoretical accounts. *Food Quality and Preference*, *40*, 165–179. doi:10.1016/j.foodqual.2014.09.013

Poelman, A., Mojet, J., Lyon, D., & Sefa-Dedeh, S. (2008). The influence of information about organic production and fair trade on preferences for and

perception of pineapple. *Food Quality and Preference*, *19*, 114–121. doi:10.1016/j.foodqual.2007.07.005

Prada, M., Rodrigues, D., & Garrido, M. V. (2016). Deliberate choices or strong motives: Exploring the mechanisms underlying the bias of organic claims on leniency judgments. *Appetite*, *103*, 8–16. doi:10.1016/j.appet.2016.03.012

Prada, M., Rodrigues, D., Silva, R. R., & Garrido, M. V. (2016). Lisbon Symbol Database (LSD): Subjective norms for 600 symbols. *Behavior Research Methods*, *48*, 1370–1382. doi:10.3758/s13428-015-0643-7

Provencher, V., & Jacob, R. (2016). Impact of perceived healthiness of food on food choices and intake. *Current Obesity Reports*, *5*, 65–71. doi:10.1007/s13679-016-0192-0

Provencher, V., Polivy, J., & Herman, C. P. (2009). Perceived healthiness of food. If it's healthy, you can eat more! *Appetite*, *52*, 340–344. doi:10.1016/j.appet.2008.11.005

Raghunathan, R., Naylor, R. W., & Hoyer, W. D. (2006). The unhealthy = tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *Journal of Marketing*, *70*, 170–184. doi:10.1509/jmkg.70.4.170

Roininen, K., Arvola, A., & Lähteenmäki, L. (2006). Exploring consumers' perceptions of local food with two different qualitative techniques: Laddering and word association. *Food Quality and Preference*, *17*, 20–30. doi:10.1016/j.foodqual.2005.04.012

Rousseau, S. (2015). The role of organic and fair trade labels when choosing chocolate. *Food Quality and Preference*, *44*, 92–100. doi:10.1016/j.foodqual.2015.04.002

Rozin, P. (2005). The meaning of "natural" process more important than content. *Psychological Science*, *16*, 652–658. doi:10.1111/j.1467-9280.2005.01589.x

Rozin, P., Spranca, M., Krieger, Z., Neuhaus, R., Surillo, D., Swerdlin, A., & Wood, K. (2004). Preference for natural: Instrumental and ideational/moral motivations, and the contrast between foods and medicines. *Appetite*, *43*, 147–154. doi:10.1016/j.appet.2004.03.005

Sabbe, S., Verbeke, W., & Damme, P. V. (2008). Familiarity and purchasing intention of Belgian consumers for fresh and processed tropical fruit products. *British Food Journal*, *110*, 805–818. doi:10.1108/00070700810893331

Schifferstein, H. N. J., & Oude Ophuis, P. A. M. (1998). Health-related determinants of organic food consumption in The Netherlands. *Food Quality and Preference*, *9*, 119–133. doi:10.1016/S0950-3293(97)00044-X

Schleenbecker, R., & Hamm, U. (2013). Consumers' perception of organic product characteristics. A review. *Appetite*, *71*, 420–429. doi:10.1016/j.appet.2013.08.020

Schuldt, J. P., & Hannahan, M. (2013). When good deeds leave a bad taste. Negative inferences from ethical food claims. *Appetite*, *62*, 76–83. doi:10.1016/j.appet.2012.11.004

Schuldt, J. P., Muller, D., & Schwarz, N. (2012). The "Fair Trade" effect: Health halos from social ethics claims. *Social Psychological and Personality Science*, 581–589. doi:10.1177/1948550611431643

Schuldt, J. P., & Schwarz, N. (2010). The "organic" path to obesity? Organic claims influence calorie judgments and exercise recommendations. *Judgment and Decision Making*, *5*, 114–150.

Shepherd, R., Magnusson, M., & Sjödén, P.-O. (2005). Determinants of consumer behavior related to organic foods. *Ambio: A Journal of the Human Environment*, *34*, 352–359. doi:10.1579/0044-7447-34.4.352

Smith, V., Barratt, D., & Selsøe, S. H. (2015). Do natural pictures mean natural tastes? Assessing visual semantics experimentally. *Cognitive Semiotics*, *8*, 53–86. doi:10.1515/cogsem-2015-0001

Smith-Spangler, C., Brandeau, M. L., Hunter, G. E., Bavinger, J. C., Pearson, M., Eschbach, P. J., … Bravata, D. M. (2012). Are organic foods safer or healthier than conventional alternatives?: A systematic review. *Annals of Internal Medicine*, *157*, 348–366. doi:10.7326/0003-4819-157-5-201209040-00007

Sörqvist, P., Haga, A., Holmgren, M., & Hansla, A. (2015). An eco-label effect in the built environment: Performance and comfort effects of labeling a light source environmentally friendly. *Journal of Environmental Psychology*, *42*, 123–127. doi:10.1016/j.jenvp.2015.03.004

Sörqvist, P., Haga, A., Langeborg, L., Holmgren, M., Wallinder, M., Nöstl, A., … Marsh, J. E. (2015). The green halo: Mechanisms and limits of the eco-label effect. *Food Quality and Preference*, *43*, 1–9. doi:10.1016/j.foodqual.2015.02.001

Sörqvist, P., Hedblom, D., Holmgren, M., Haga, A., Langeborg, L., Nöstl, A., & Kågström, J. (2013). Who needs cream and sugar when there Is eco-labeling? Taste and willingness to pay for "eco-friendly" coffee. *PLOS ONE*, *8*(12), e80719. doi:10.1371/journal.pone.0080719

Sörqvist, P., Langeborg, L., & Marsh, J. E. (2016). Social desirability does not underpin the eco-label effect on product judgments. *Food Quality and Preference*, *50*, 82–87. doi:10.1016/j.foodqual.2016.01.010

Sörqvist, P., Marsh, J. E., Holmgren, M., Hulme, R., Haga, A., & Seager, P. B. (2016). Effects of labeling a product eco-friendly and genetically modified: A cross-cultural comparison for estimates of taste, willingness to pay and health consequences. *Food Quality and Preference*, *50*, 65–70. doi:10.1016/j.foodqual.2016.01.007

Szocs, C., & Lefebvre, S. (2016). The blender effect: Physical state of food influences healthiness perceptions and consumption decisions. *Food Quality and Preference*, *54*, 152–159. doi:10.1016/j.foodqual.2016.07.009

Thogersen, J., & Bredahl, L. (2006). Cross- national and lifestyle differences in consumer choice criteria and motives with regard to a processed organic food. *Asia-Pacific Advances in Consumer Research*, *7*, 60–70.

Thorndike, E. L. (1920). A constant error in psychological ratings. *Journal of Applied Psychology*, *4*, 25–29. doi:10.1037/h0071663

Tobin, R., Moane, S., & Larkin, T. (2013). Sensory evaluation of organic and conventional fruits and vegetables available to Irish consumers. *International Journal of Food Science & Technology*, *48*, 157–162. doi:10.1111/j.1365-2621.2012.03172.x

van Doorn, J., & Verhoef, P. C. (2011). Willingness to pay for organic products: Differences between virtue and vice foods. *International Journal of Research in Marketing*, *28*(3), 167–180. doi:10.1016/j.ijresmar.2011.02.005

van Herpen, E., Immink, V., & van den Puttelaar, J. (2016). Organics unpacked: The influence of packaging on the choice for organic fruits and vegetables. *Food Quality and Preference*, *53*, 90–96. doi:10.1016/j.foodqual.2016.05.011

Wansink, B., & Chandon, P. (2006). Can “low-fat” nutrition labels lead to obesity? *Journal of Marketing Research*, *43*, 605–617. doi:10.1509/jmkr.43.4.605

Wiedmann, K.-P., Hennigs, N., Behrens, S. H., & Klarmann, C. (2014). Tasting green: an experimental design for investigating consumer perception of organic wine. *British Food Journal*, *116*, 197–211. doi:10.1108/BFJ-04-2012-0090

Williams, C. M. (2002). Nutritional quality of organic food: Shades of grey or shades of green? *The Proceedings of the Nutrition Society*, *61*, 19–24.