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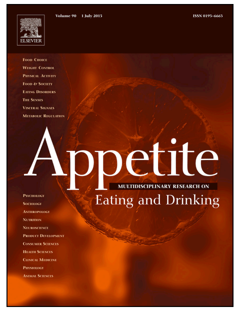

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Organic food labels bias food healthiness perceptions: Estimating healthiness equivalence using a Discrete Choice Experiment

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Abstract

Individuals perceive organic food as being healthier and containing fewer calories than conventional foods. We provide an alternative way to investigate this organic halo effect using a mirrored method to Choice Experiments applied to healthiness judgments. In an experimental study (*N* = 415), we examined whether healthiness judgments toward a 200g cookie box are impacted by the organic label, nutrition information (fat and sugar levels), and price and determined the relative importance of these attributes. In particular, we assessed whether food with an organic label could contain more fat or sugar and yet be judged to be of equivalent healthiness to food without this label. We hoped to estimate the magnitude of any such effect. Moreover, we explored whether these effects were obtained when including a widely used system for labeling food healthiness, the Traffic Light System. Although participants' healthiness choices were mainly driven by the reported fat and sugar content, the organic label also influenced healthiness judgments. Participants showed an organic halo effect leading them to consider the organic cookie as healthy as a conventional one despite containing more fat and sugar. Specifically, they considered the organic cookie as equivalent in healthiness to a conventional one, although containing 14% more of the daily reference intake for sugar and 30% more for fat. These effects did not change when including the Traffic Light System. This effect of the organic label could have implications for fat and sugar intake and consequent impacts on health outcomes.

Keywords: Organic food label, perceived healthiness, fat intake, sugar intake.

1. Introduction

Research regularly shows the excessive consumption of saturated fats, cholesterol, and sugars in most Global north countries (Schmidhuber & Traill, 2006). Therefore, it seems important to investigate the elements that help individuals make healthier choices, i.e., opt for products reduced in fat and sugar. Food choice decisions are complex, considering the increasing variety of food products offered in supermarket aisles. Regarding food choice decision making, research suggests that individuals use a personal food system in which health, taste, cost, and convenience are the most influential values (Connors et al., 2001; Furst et al., 1996). A food choice decision is thus partly based on the healthiness perception of the different products from which one has to choose.

While evaluating the healthiness of natural food could seem relatively straightforward, the process might be different for processed food. Nutritional knowledge might play a role, but research shows that participants tend to base healthiness judgments on nutrient claims, brands, price, labels, and country of origin (Machìn et al., 2020). For example, consumers tend to link price and healthiness positively (Haws et al., 2017; Jo & Lusk, 2018; Machìn et al., 2020). In recent years, governmental organizations or food manufacturers have developed a series of Front of Package (FoP) labelings varying in colors and formats to communicate food's nutritional content and relative healthiness. These FoPs, like the Traffic Light System, have proven helpful to evaluate products' healthiness (e.g., Acton et al., 2018; Hagmann & Siegrist, 2020; Maubach et al., 2014; Watson et al., 2014). However, food companies have also started to add several labels or images regarding the food origin or the transformation process that are sometimes mistakenly taken as health information (e.g., Klepacz et al., 2016). Often, a label attached to a particular food influences the ratings of unrelated characteristics. This contribution focuses on the organic label that is perceived as healthier and containing fewer fat and calories. Starting from this halo effect, we examine the consequences of the organic label on the healthiness perception of a common food when individuals receive other information that can impact healthiness perception (i.e., price and nutrition facts information). This study offers the possibility to calculate the acceptable additional quantity of sugar and fat a food labeled as organic can contain compared to a conventional product.

1.1. Halo effect of the organic claim

The halo effect can be defined as the influence of a global evaluation of an object or a person on the attribution of characteristics to this object or person. Originally studied in the person perception domain (Nisbett & Wilson, 1977; Thorndike, 1920), halo effects also affect food perceptions and evaluations. The identity or origin of the product leads to various halo effects that influence the attribution of health or nutrition properties (e.g., Caporale & Monteleone, 2004; Schuldt et al., 2012; Sütterlin & Siegrist, 2015). For example, individuals believe that chocolate tagged as belonging to fair trade (Schuldt et al., 2012) or cheese labeled as local (Demartini et al., 2018) or traditional (Richetin et al., 2020) is healthier than alternative products not so marked. More central to our concerns, consumers also infer beliefs of subjective quality from an organic label (Hughner et al., 2007). Organic food is perceived as lower in fat and calorie content, higher in fiber, and healthier than conventional foods (W. J. Lee et al., 2013; Schuldt & Hannahan, 2013; Schuldt & Schwarz, 2010). Because of these inferences, individuals think that organic cookies can be eaten more often (Schuldt & Schwarz, 2010) and contribute to leniency judgments when skipping diet or exercise (Prada et al., 2016; Schuldt & Schwarz, 2010). Whereas the lack of pesticides in organic products could be one aspect of the healthiness, the lower calorie and fat content inferences are not linked to any nutritional evidence. This biased perception has been labeled as the organic halo effect: The presence of the organic label leads individuals to infer properties about the fat and calorie content.

Taken together, research converges in evidencing an organic halo effect that leads individuals to infer healthiness and lower calorie content. However, no research investigated how much the organic label biases the healthiness perception, especially when presented alongside information about the product's nutritional values.

1.2. Traffic Light System (TLS) nutritional food label

The nutrition facts panel on food packages was designed to provide comprehensible quantitative nutrition information to allow consumers to make more informed food choices that could result in significant long-term health benefits. However, it does not always lead individuals to correctly perceive the healthfulness of certain foods (e.g., Graham & Mohr, 2014). The Food Standards Agency has developed the Traffic Light System (TLS) in the United Kingdom (or the Nutri-Score or 5-Color Nutrition label in France) to decrease the nutrition information's complexity and increase its visibility. It features green, yellow, and red colors to signal relatively healthy, intermediate, and unhealthy macro-nutrient levels. Research has investigated the impact of the TLS on evaluations and choices. The TLS has been shown to be more effective than other FoPs in differentiating healthiness (Maubach et al., 2014; Talati et al., 2017), especially for distinguishing very contrasted options (Talati et al., 2017). One study (Balcombe et al., 2010) showed a strong avoidance of a basket of foods with any "Red" lights. Results suggest that the color-coding's signaling effect helps to reduce the complexity of decision-making (Hieke & Wilczynski, 2011) and to identify healthier products (Hawley et al., 2013; Hieke & Wilczynski, 2011; Temple, 2020). Eye-tracking studies demonstrated the superiority of the TLS compared to standard nutrition facts table or Guideline Daily Amounts in capturing, directing attention toward, and processing the information most relevant to healthiness assessments (Jones & Richardson, 2007; Siegrist et al., 2015). However, other studies deliver less consensual results. For example, the TLS performed as well as other FoPs in helping consumers in determining healthiness (Hodgkins et al., 2015; Watson et al., 2014). Moreover, whereas the TLS helps identify products' healthiness correctly, it does not seem to be translated into behavioral choices (Aschemann-witzel et al., 2013; Borgmeier & Westenhoefer, 2009; Sacks et al., 2009). Note that this lack of effect on behavior has also been demonstrated for other FoP labelings (Roberto et al., 2012). Despite these limitations, it seems that the TLS influences individuals because of the "stop" and "go" logic behind the traffic light labels (Trudel et al., 2015), being somehow directive (Hodgkins et al., 2012), leading to the avoidance of red attributes (Balcombe et al., 2010) and the approach (i.e., choice and consumption) of green ones.

However, this logic can also have negative effects since highlighting some attributes can bias individuals and lead them to choose unhealthier options. For instance, keeping constant the information about the calorie content, participants judged a chocolate bar to be healthier when its calorie label was green (vs. red) (Schuldt, 2013). Based on this evidence, Schuldt (2013) suggested that the organic halo effect could result from a learned association between the green organic logo and healthy. Because organic logos are usually green, individuals associate organic food labels with healthy products, influencing evaluations and choices. One could wonder how the greenness of the organic label would influence healthiness perception in the context of the TLS. Let's suppose that the TLS provides more explicit nutritional information and leads individuals to pay more attention to the nutritional content. One could hypothesize that the organic label's role might be attenuated in this situation. Thus one could expect that individuals in the TLS condition would show a weaker bias in perceiving the organic product as healthier than the non-organic product compared to individuals in the no TLS condition. Alternatively, in the TLS, green indicates something healthy (i.e., low fat and low sugar), and the organic label is green. Thus, one could expect that individuals in the TLS condition would show a stronger bias in considering the organic product as healthier than the non-organic product compared to individuals in the no TLS condition. To our knowledge, no study has examined whether the organic logo, presented together with the nutrition facts in different formats, including the TLS, will still have the same influence, let alone the quantification of its importance in the healthiness perception.

1.3. Healthiness Equivalence in Choices

In economics and applied economics, Discrete Choice Experiments are commonly used to examine consumer preferences, including food choices, as they demonstrate good external validity (Brooks & Lusk, 2010; Louviere et al., 2000; Swait & Andrews, 2003). More central to our concerns, Discrete Choice Experiments provide insightful information on the values individuals attach to experimentally designed attributes, i.e., the relative importance of these attributes in determining their choices (Hauber et al., 2016; Kuhfeld, 2003). Typically, Discrete Choice Experiment food studies are used to estimate the money individuals are willing to pay to purchase their preferences for food product attributes (Willingness to Pay) (e.g., Hensher et al., 2005). As mentioned before, research using DCEs showed that individuals were willing to pay more for organically produced food products (e.g., Hasselbach & Roosen, 2015; Van Loo et al., 2011).

However, DCE can be used other than calculating the willingness to pay for a food product. Health economists are used to calculating trade-offs between non-monetary attributes in cost-benefit analysis, such as risk or time equivalence in medical treatments (Hauber et al., 2016; Mott et al., 2020). Applying this logic to the study of healthiness perception, instead of focusing on eliciting consumers' preferences for food attributes and estimating monetary equivalence between an organic and a conventional product, one could use the DCE method to evaluate the healthiness equivalence between the two products. This method allows going beyond the evidence that organic food is judged healthier, as demonstrated in previous research. It offers the possibility to calculate the acceptable additional quantity of sugar and fat in a common food to get the organic logo, in other words, to consider the organic and the conventional as healthily equivalent.

1.4. Aims

Previous research demonstrated an advantage of the organic label in terms of healthiness perception. However, to our knowledge, no published study has investigated the influence of this organic label on healthiness perception in the context of other potentially useful information and tried to quantify this bias. In this contribution, we adapted the Discrete Choice Experiment into a Discrete Healthiness Choice Experiment to explore the relative importance of the role of the sugar and fat-related nutritional information, price, and organic label on healthiness preference choices to estimate the Healthiness Equivalence in sugar and fat. We aimed to examine whether participants would consider food with an organic label equivalent to a non-organic one in terms of healthiness, despite containing more fat or sugar. To our knowledge, this is the first time a Discrete Choice Experiment procedure has been used to investigate the healthiness perception of food. This contribution would also be the first to test whether the organic label has some influence despite the nutrition information. Moreover, prior research seems to indicate the benefit of using the Traffic Light System (TLS) for understanding nutritional information and choosing healthier products (e.g., Borgmeier & Westenhoefer, 2009). It thus remains unclear whether the presence of the TLS facilitates healthiness perception, especially when coupled with the organic label that has been shown to bias healthiness perception. In our contribution, we used the TLS to investigate whether using it for the nutrition facts (sugar and fat content in grams and reference daily intake) or not leads to an attenuating or even accentuating of the organic label's effects. Besides fat and sugar information and the organic label, we also included price as an attribute. Price is considered a healthiness indicator by consumers (Haws et al., 2017; Jo & Lusk, 2018; Machìn et al., 2020), but its influence has not been tested systematically. Moreover, including it as an attribute also made the choice situation more similar to the one individuals encounter every day at the supermarket, and therefore more ecologically valid. Our study tested experimentally whether participants would find a high-priced product as healthily equivalent as a low price, though containing more fat or sugar. Finally, we focused on cookies as the target products because they are classified as an example of high-energy sweet snacks that usually contain high amounts of sugar and fat (Whybrow et al., 2005). Moreover, snacking contributes 15–30% of daily energy in the US and European countries (Mattes, 2018), and it is often assumed to contribute to the increase in the prevalence of obesity (Zizza et al., 2001).

2. Method

2.1. Sample size determination

The current sampling theory has not yet adequately addressed the sample size requirements for Discrete Choice Experiments regarding the reliability of estimates produced (Rose & Bliemer, 2013). Considering that we were interested in simple models with main effects only, simulated scenarios (Johnson et al., 2013) suggest that a sample size of 200 participants for each condition (TLS absent vs. present) is satisfactory.

2.2. Participants and Procedure

Participants were recruited online through social networks and a university-based participant pool management system. Four hundred and fifteen Italian participants completed the study online (see Table 1 for the sample's socio-demographic information). They first provided their informed consent. Then, participants were given instructions regarding the information they will receive about the products in the Healthiness Choice Experiment[1] (i.e., organic logo, price, and nutrition facts, see Supplementary Material for the detailed instructions). They were randomly and blindly allocated to one of two conditions (no TLS, *N* = 222 vs. TLS, *N* = 193). They subsequently completed a series of 9 Healthiness choices in which they chose the healthiest product between two products or "I do not know" (no knowledge option). The University Ethics committee approved the study (RM-2018-145).

2.3. Healthiness Choice Experiment Design

During the Healthiness choice experiment, respondents were asked to make healthiness choices between two 200g cookie boxes offered at different prices and an "I do not know" (or opt-out) alternative. This last option was included considering that some respondents might not be able

[1] The study also included some additional measures and a Choice Experiment in which participants were presented with the same pairs of products but they had to indicate the one they would buy. Because here we were interested in the healthiness perception and not buying intention, we do not report the results of the Choice Experiment. They are being reported in a separate manuscript.

to judge the product alternatives' healthiness. Each product was described by the following attributes and attribute levels: organic (absent vs. present), fat content (low: 2.3g per 100g or 3.07% of reference daily intake vs. medium: 12.3g per 100g or 16.4%, vs. high: 22.3g per 100g or 29.7%), sugar content (low: 2.1g per 100g or 2.3% or daily reference intake vs. medium: 12.1g per 100g or 13.5%, vs. high: 22.1g per 100g or 24.7%), and price (i.e., 0.70 Euro, 1.70 Euro, 2.70 Euro, 3.70 Euro). We focused on sugar and fat because they were shown to be the most critical nutrition information attributes (Balcombe et al., 2010; but see Hieke & Wilczynski, 2011). We used the nutrition facts standards to establish the levels of sugar and fat based on market nutrition facts such that there was a difference of 10g/100g between each of them. The four price levels were selected to capture the actual price distribution for all cookies (200g box) products in the market so that there was a difference of 1 Euro between each of them starting from the low price. Salt information was also indicated but kept fixed to make the information as realistic as possible. We removed the other information usually presented in the nutrition facts (i.e., saturates and calorie content) because it would result in too much information.

We used a between-sample approach in which the nutrition facts were presented only with numbers (TLS absent, $n = 222$) or with numbers and the TLS (i.e., color-coding) for sugar and fat separately (TLS present, $n = 193$) (see Supplementary Material for an example of each condition). For the TLS condition, the same standard color code was used for the fat and the sugar content. Low was indicated in green (2.3g per 100g or 3.07% of reference daily intake and 2.1g per 100g or 2.3% or daily reference intake, respectively), medium in amber (12.3g per 100g or 16.4% and 12.1g per 100g or 13.5%, respectively), and high in red (22.3g per 100g or 29.7% and 22.1g per 100g or 24.7%, respectively).

Given the number of attributes and attribute levels, a full factorial design with two product profiles would have resulted in more than 5,184 (4^{1x2} 2^{2x1} 3^{2x2}) possible choice questions. To reduce the number of questions respondents had to answer during the experiments, we followed Burgess and Street's (2005) suggestion. We generated a D-Optimal design, which resulted in 72 choices (36 for each information between conditions). To further reduce fatigue, within each condition, we divided the 36 choice questions into four blocks. Respondents were randomly assigned to one of the four blocks, thus responding to only nine choice questions.

2.4. Data Analysis[2] and Results

2.4.1. RPL-EC model for Healthiness choice

We computed estimates with a Random Parameters Logit model (RPL) (Train, 2009). Like the multinomial logit model (MNL) (McFadden & Train, 2000), the RPL model assumes that the ε_{nit} are independent and identically distributed (iid) across the i alternatives, n individuals, and t choice situations with a Type I extreme value distribution. In addition to the MNL, it allows for random preferences, correlation in unobserved factors over time, and unrestricted substitution patterns (Train, 2009). The model parameters were estimated by simulated maximum likelihood estimation techniques following (Train, 2009) using Halton draws (1000) to provide a more efficient simulation for this model than random draws (Bhat, 2003). Please refer to the Supplementary Material for technical details about the analysis.

We estimated two RPL models, considering the two conditions separately (TLS absent vs. TLS present). Each model also included an error component to accommodate substitution patterns between the "opt-out" alternative and the two designed alternatives in the CE question (Scarpa et al., 2005, 2007). For each condition (Traffic Light: Present vs. Absent) separately, the RPL model allows estimating the parameters or coefficients (β) of each attribute (i.e., Sugar information, Fat information, Organic information, Price information) in determining the perceived healthiness across all choices and participants.

The RPL-EC estimates are shown in Table 2. In both conditions (TLS present or not), the coefficients for opt-out ("I do not know" option) were significant and negative, indicating that, on

[2] All data, analysis code, and research materials are available upon request to the first author.

average, individuals rarely responded that they did not know which of the two products was the healthiest. In other words, respondents thought they were able to establish the healthiness of the two products. For the Price, the coefficient was not significant in the two TLS conditions, indicating a lack of effect of the price on a cookie box's healthiness perception. For both conditions, the fat and sugar parameters were significant and negative, indicating an increase in fat and sugar would decrease the cookie box's healthiness perception. More central to our concerns, the Organic label coefficients were significant and positive, which implies increased healthiness perception when the label was present in both TLS conditions. In other words, the Organic label influenced the healthiness perception whether participants were presented the information with or without TLS:

2.4.2. Attributes' Relative Importance

Then, we estimated the relative importance of each parameter or coefficient in driving participants' healthiness preference for the attributes that showed a significant contribution to the choice adopting Troiano and colleagues' method (Troiano et al., 2019) that provides a percentage. This method has the advantage of allowing comparing the relative importance of each attribute within and between the two conditions (TLS: absent vs. present).

Figure 1 reports the relative importance of the significant attributes (i.e., Organic label, fat, and sugar) in contributing to the cookies' healthiness perception. As one would have expected, the impact of the nutritional information (i.e., sugar and fat content) was more important than the organic label information. However, the fact that the organic label plays a role demonstrates the halo effect. Moreover, it appears that each attribute's relative importance does not vary as a function of the presence of TLS or not. In sum, the presence of the TLS does not attenuate or accentuate the effect of each attribute, including the Organic label.

2.4.3. Healthiness equivalence

Finally, because the organic label influenced the healthiness perception, we computed the indices for Healthiness Equivalence of the Organic label to understand the consequences in terms of the nutritional perception of organic food. We estimated how much more sugar or fat an organic cookie could contain to be perceived as healthy as a non-organic cookie (Healthiness Equivalence Sugar, HES Organic; and Healthiness Equivalence Fat, HEF Organic, respectively). We computed a ratio between the parameter estimates of the Sugar or Fat attribute and the Organic attribute as follows:

$HES = -1 * \frac{Organic\ \beta}{Sugar\ \beta}$ and $HEF = -1 * \frac{Organic\ \beta}{Fat\ \beta}$, respectively.

Standard errors and 95% confidence intervals for HES and HEF are computed with a parametric bootstrapping method (Krinsky & Robb, 1986). By looking at the overlap of the confidence intervals, this approach allowed us to test if estimates of HES and HEF are significantly different between the two conditions (TLS absent vs. TLS present).

The estimates for Healthiness Equivalence Sugar and Fat are shown in Table 3. These estimates indicate that when the TLS was absent, on average, individuals tended to consider as equivalent in terms of perceived healthiness organic cookies that have 3.96grams of sugar per 100g more than non-organic cookies. This difference was 3.82 grams per 100g when the TLS was present. Regarding fat, when the TLS was absent, on average, individuals tended to consider as equivalent in terms of healthiness a box of organic cookies with 2.94 grams of sugar per 100g more than a box of non-organic cookies. This difference was 3.02 grams per 100g when the TLS was present. Thus, the Organic label impacts the perceived healthiness in both TLS present and absent conditions. The 95% confidence intervals indicate no significant differences in HES and HEF across the TLS absent and TLS present conditions. Again, the use of the TLS did not attenuate or increase this organic halo effect.

3. Discussion

The existing literature converges in showing that organic food is perceived as healthier and containing fewer calories (W. J. Lee et al., 2013; Schuldt & Schwarz, 2010). With this contribution, we went one step further in describing the organic halo effect in terms of perceived sugar and fat content. We examined whether people may judge as equivalent in healthiness an organic product as a non-organic one, despite the former containing more sugar or fat. Results are manifold.

First, they showed that participants considered that the organic cookies were healthier than the non-organic ones. Second, even if its importance for determining healthiness is smaller than relevant information such as the fat and sugar content, the organic label drives the healthiness perception of food, even when presented alongside the objective information about sugar and fat. These findings corroborate the Organic halo and the distorted perception of organic food's nutritional content (W. J. Lee et al., 2013; Schuldt & Hannahan, 2013; Schuldt & Schwarz, 2010). Third, we were able to quantify the magnitude of the biasing effect of the organic label. In terms of consequences of this distorted perception, results showed that across conditions and on average, individuals tended to consider as equivalent in terms of perceived healthiness cookies labeled as organic that had 3.89 grams of sugar or 2.98 grams of fat per 100g more than cookies not labeled as organic. Translated into practical terms, it means that individuals tend to consider as healthy as non-organic cookies, organic cookies that, in terms of sugar and fat, contain approximately 15 and 27 calories more per 100g, or 14% and 30% of the daily reference intake. To our knowledge, this is the first study showing the potentially negative consequences of the organic halo effect in terms of healthiness perception equivalence.

It is important to underline that this misperception was observed in both conditions (TLS present or absent). Thus, including a TLS did not attenuate the organic label's impact by clarifying the nutritional information (Borgmeier & Westenhoefer, 2009) or accentuate its impact because of its green color consistent with a healthier product (Schuldt, 2013). This lack of moderation from the TLS seems inconsistent with the numerous studies showing that it helps identify healthier products (Hagmann & Siegrist, 2020; Hawley et al., 2013; Hieke & Wilczynski, 2011; Temple, 2020). One could hypothesize that this lack of influence might be because the TLS, although reduced in its form here, provided two colors, one for fat and one for sugar, whereas the organic label provides a single piece of information. In other words, the TLS does not provide a global evaluation of the product's healthiness. Participants in this study had to infer the cookie's healthiness from the two colors that sometimes were conflicting (e.g., red for sugar, green for fat). One might obtain different results when the organic logo is contrasted with simpler labels such as recent single-summary labels (e.g., Keyhole, Green Tick, Choices labels, Nutri-Score, and Health Star Rating labels). For example, findings have suggested that the Nutri-Score is easier for consumers to understand and results in more accurate healthiness evaluations than the TLS (Ducrot et al., 2016; Hagmann & Siegrist, 2020). Future research should investigate whether a single-summary label could moderate the organic halo effect on healthiness perception.

Our results also showed that in both formats (TLS and no TLS), an increase in fat and sugar decreases the cookies' healthiness perception. Participants thus understood the nutritional information (Grunert et al., 2010) and associated a high quantity of fat and sugar with unhealthiness (Bucher et al., 2015). Therefore, one cannot attribute the organic advantage to not understanding the nutrition facts in terms of healthiness information about the product. As a final note, the price did not affect healthiness perception. Although there is evidence for a relationship between perceived quality and price (Bagwell & Riordan, 1991; Dawar & Parker, 1994; Gerstner, 1985; Zeithaml, 1988) and between price and healthiness (Haws et al., 2017; Jo & Lusk, 2018; Machìn et al., 2020), it does not apply to healthiness perception in this study. Recent research showed that health-related FoPs seem to work better on cheaper products (Maesen et al., 2021). Our results show that price is not significant independently from the presence or the absence of the TLS. Future research should investigate more systematically the role of price in interaction with other attributes from which individuals infer healthiness.

In general, this contribution also provides a new approach to the study of the organic halo effect. Choice Experiments are usually employed to understand how monetary decisions are influenced by a series of information about the product. We applied the same logic and developed a mirrored method to understand better how healthiness judgments can be impacted by a series of information such as nutrition information, price, and, most importantly, organic label. Rather than asking individuals explicitly which product is healthier or how healthy is a product, we proposed a method that provides an approach with more ecological value. In everyday shopping activities, individuals are confronted with a range of products for which the front-package information includes nutrition facts and various labels such as the organic one. The decision process that leads them to decide to go for one type or the other might be partly based on a healthiness attribution, although it might not be explicit.

In terms of limitations, one could raise the point that we focus only on one food type. On the one hand, one study (Prada et al., 2017) showed that processed compared to whole food did not benefit from the organic label advantage in terms of perceived calorie content. On the other hand, another study shows that an organic label increases the intention to consume vice food (i.e., regular cookies) and decreases the intention to consume virtue food (i.e., cookies rich in fiber and protein) (H. C. Lee et al., 2018). Our research used regular cookies that are typically considered highly processed, vice food, and a typical snack, with snacks often assumed to be related to the prevalence of obesity (Zizza et al., 2001). Considering the organic advantage we observed, future research might investigate whether this effect using this specific methodology generalizes to different kinds of food, processed or whole, perceived as vice or virtue food. With the same aim of generalization, one might wonder whether the effect would occur with a different organic label, considering that we used the standard European one. One could also raise the issue that we did not present the complete set of usual nutrition facts information. We chose to do so for the sake of simplicity, manipulating only a few information among which only two were linked to nutrition information (i.e., sugar and fat content). One could wonder whether including the calorie information would attenuate the organic halo effect, especially if one hypothesizes that individuals can have difficulty to translate the sugar and fat content into calorie content. The organic halo effect resides mainly on the organic food being perceived as less caloric (Schuldt & Schwarz, 2010). A study using the same methodology in which the calorie content information is manipulated would provide an even stronger test of the organic halo effect. Moreover, one should note that, although participants were informed at the beginning of the study of the meaning of the color-coding information in the TLS condition, this FoP format is not used in Italy, where the study was conducted. Future research could investigate whether the familiarity together with the simplicity of the nutrition information (TLS vs. single-summary label) would affect the organic halo. Another limitation could reside in the use of hypothetical choices. Discrete Choice Experiments are a widely used and valid method to examine various attributes' role in decision-making processes. However, one could wonder whether the results on perceived healthiness would generalize to actual choice. Future research should examine this issue in lab settings measuring actual behavior. On the one hand, some research showed that the TLS influences healthiness perceptions but not behavior (Borgmeier & Westenhoefer, 2009). On the other hand, previous studies showed an effect of the organic label in preference-based choices (e.g., Van Loo et al., 2011). Moreover, empirical evidence demonstrated that the presence of an organic-labeled food (compared to a no-labeled food) increased the neural encoding of reward in the ventral striatum, and differences in this encoding were related to self-reported organic food consumption (Linder et al., 2010). It is thus important to investigate whether our results translate into eating behavior. For example, future research could test whether the organic effect on healthiness perception would lead individuals to eat more cookies. Finally, although our sample was quite heterogeneous in terms of occupation and age, this study was conducted on a convenience sample. Future research should try to test whether the same biased perception would occur among regular supermarlet consumers for example.

In conclusion, previous studies showed an organic halo effect consisting in perceiving organic food as healthier and less caloric than non-conventional food. Our study extended these results by showing that the organic label biases perception such that a common food product labeled organic that contains more fat and sugar than a food product not labeled as organic is still judged as healthier. The results dovetail with results showing an impact of organic claims on leniency judgments (Prada et al., 2016; Schuldt & Schwarz, 2010) interpreted as a licensing effect (Prada et al., 2016). The extra fat or sugar in the cookies is perceived as less a deviation from healthiness because it is organic. This effect is estimated to bias evaluations up to 30% of the daily reference intake. In contradiction with research showing facilitation of the Traffic Light System in healthiness inferences, in this contribution, it did not help in reducing the organic halo bias. Considering the neural reward value of organic food and its relation to actual consumption (Linder et al., 2010), the perverse implication of the organic halo effect is that people may mistakenly intake more fat and/or sugar than they think, with consequent impacts on health outcomes. In 2006, a European regulation specifically addressed nutrition and health claims to avoid misunderstanding and protect consumers against false information (Regulation (EC) No., 1924/2006). However, it seems the health claim of the organic label (due to the absence of pesticides, for example) is transformed into a nutrition claim in the eye of the consumer. Policymakers might want to consider insisting on the distinction between these two claims and how some labels might blur the distinction.

Author Contributions

JR, VC, ED, MC, and MP participated in the conceptualization of the studies; JR organized the data collection, VC and ED analyzed the data; JR, VC, and ED wrote the draft; JR, VC, ED, MC, and MP reviewed, revised and edited it. All authors approved the final article.

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Table 1

Descriptive information of the study sample

	All	TLS condition	
		Absent	Present
Age	35.13 (13.7)	35.67 (13.67)	34.50 (13.54)
Gender			
Man	159	83	76
Woman	254	139	115
Other	2	0	2
Education			
Nursery school to 8th grade	1	0	1
Some high school, no diploma	29	15	14
High school graduate	172	98	74
Bachelor's degree	94	48	46
Master's degree	110	55	55
Doctorate degree	9	6	3
Employment			
Self-employed	72	41	31
Employed for wages	193	106	87
Out of work	20	12	8
Homemaker	13	8	5
Student	81	38	43
Military	2	1	1
Retired	15	9	6
Other	19	7	12
Number of respondents	415	222	193

Table 2.

RPL-EC model Correlated Random Coefficients estimates for Healthiness choice

	No Traffic Light	Traffic Light
Estimated Parameters		
Opt-Out (I do not know)	**-7.99****(0.65)	**-7.89****(0.57)
Price	0.03(0.07)	0.08(0.08)
Organic	**0.59****(0.13)	**0.71****(0.14)
Sugar	**-0.15****(0.02)	**-0.19****(0.02)
Fat	**-0.20****(0.02)	**-0.23****(0.02)
SD of Random Parameters		
Organic	**0.81****(0.13)	**0.96****(0.17)
Price	**0.29****(0.10)	**0.41***(0.09)
Sugar	**0.15****(0.02)	**0.12****(0.01)
Fat	**0.14****(0.02)	**0.14****(0.01)
Error Random Component	**4.46****(0.37)	**3.83****(0.39)
N Observations	1998	1737
N Respondents	222	193
Log Likelihood	-1055.19	-880.54
Adj *R*2	.52	.54
BIC/N Respondents	1.08	1.04

Note. Standard errors are indicated in parentheses.

$^{**}p < .01.^{*}\ p < .05.$

Table 3.

Mean Healthiness Equivalence of a cookie box in Sugar and Fat estimates (in grams of fat or sugar /100g) from the RPL-EC model computed separately for both TLS conditions (No Traffic Light vs. Traffic Light)

	No Traffic Light (*N* = 222)		Traffic Light (*N* = 193)	
	M (*SE*)	95% Bootstrap CI	*M* (*SE*)	95% Bootstrap CI
Health Equivalence Sugar	3.96** (0.92)	[2.15, 5.76]	3.82*** (0.74)	[2.36, 5.27]
Health Equivalence Fat	2.94** (0.65)	[1.67, 4.22]	3.02** (0.62)	[1.79, 4.24]

Note. For both Healthiness equivalence indexes, the overlap of the confidence intervals between the two conditions (No Traffic Light vs. Traffic Light) indicates a lack of significant differences.

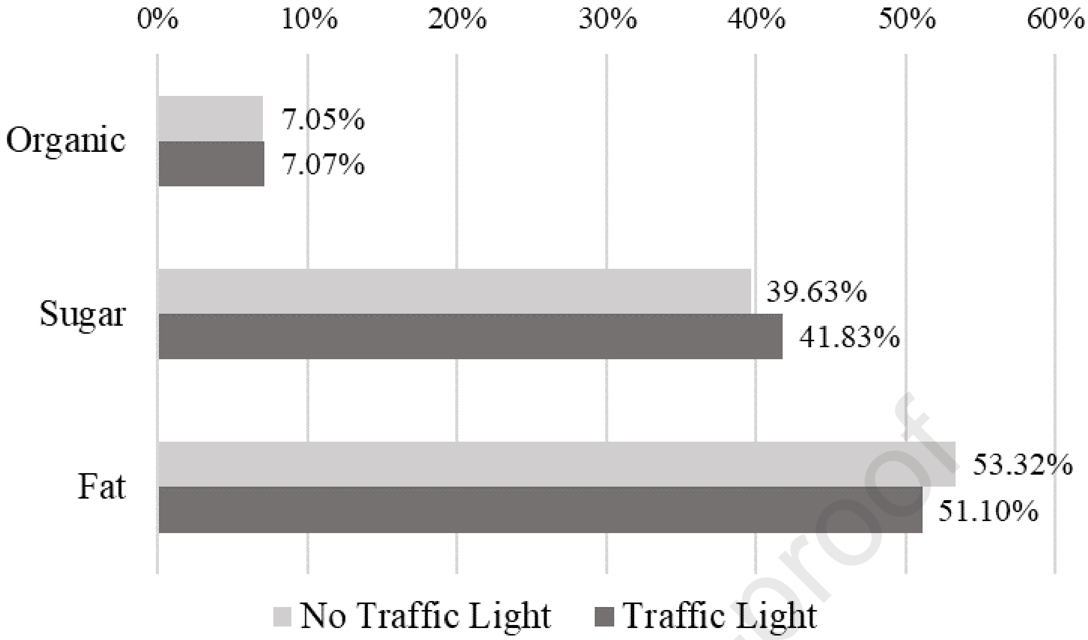

Figure 1. The relative importance of each significant attribute in driving participants' perception of healthiness in both TLS conditions (No Traffic Light vs. Traffic Light).

The research was conducted in accordance with the Declaration of Helsinki, and the Ethics committee of the University of Milano-Bicocca approved the protocol of the study (RM-2018-145).