The ABC's of ecological and nutrition labels. The impact of label theme and complexity on the environmental footprint of online eating choices.

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Abstract:

Current food consumption patterns threaten our global environment. Food choices are generally based on quick and automatic processes, and are therefore influenced by cues. The goal of the current research is to investigate whether specific information cues (i.e., eco labels and nutrition labels) can influence more sustainable food choices. Two online experiments were carried out in which young adults chose products and quantities for a one-person meal. In the first study (N = 142), we varied the label theme alongside the products: eco label, nutrition label or no label. In the second study (N = 250), we also varied the level of complexity: interpretative (i.e., simple) vs. reductive (i.e., detailed). The two studies revealed mixed results. The aggregated results revealed that (both simple and detailed) eco labels can lead to more sustainable choices. In conclusion, our findings suggest that eco labels may be a good strategy to promote a more sustainable diet.

Keywords: Informational cues; Food consumption; Sustainability

Track: Consumer Behaviour

1. Introduction

Food consumption is highly connected to sustainability. To mitigate climate change, more sustainable diets should be promoted, i.e., with high quantities of plant-based products and limited quantities of animal-based products (Aleksandrowicz, Green, Joy, Smith, & Haines, 2016). However, despite increasing interests in sustainability, the consumption of unsustainable food products such as meats and dairy has remained high throughout the years.

Environmental motives often play a role in food choices (Siegrist & Hartmann, 2019; Wunderlich & Gatto, 2016). However, it is important that this motive is activated at point-of-purchase (Ungemach, Camilleri, Johnson, Larrick, & Weber, 2017). Moreover, people are often unware about the sustainability of food products (Hartikainen, Roininen, Katajajuuri, & Pulkkinen, 2014; Siegrist & Hartmann, 2019), and could benefit from informational cues such as eco labels at the point-of-purchase (Camilleri, Larrick, Hossain, & Patino-Echeverri, 2019).

However, most research on labels so far has focused on the impact of nutrition labels (Hallez, Qutteina, Raedschelders, Boen, & Smits, 2020). A number of recent studies have investigated the role of the so-called 'nutri-score' label. This label presents a summary of a product's overall nutritional value, with a colour and a letter. The nutri-score has been found to impact healthy purchase intentions (De Temmerman, Heeremans, Slabbinck, & Vermeir, 2020) and choices (Poquet et al., 2019). The success of this label may (partly) be explained by its simple and evaluative nature. A distinction is commonly made between interpretative (i.e., simple, evaluative) and reductive (i.e., factual, detailed) labels (Ikonen, Sotgiu, Aydinli, & Verlegh, 2020). Interpretative nutrition labels are commonly preferred by consumers (Hawley et al., 2013) and are often considered to be more effective (Hallez et al., 2020).

There has been much less research into the impact of eco labels. However, a number of studies have shown that European consumers find the current eco labels confusing and complicated (see e.g., Goossens et al., 2017; Hartikainen et al., 2014). The introduction of a single, interpretative eco label could aid consumer understanding and limit the noise in the retail environment. Similar to the nutri-score label, such a label should establish a summary sustainability score and allow comparison between food products (Goossens et al., 2017; Hartikainen et al., 2014).

To date, four experimental studies have investigated the impact of interpretative eco labels and all four found that they can influence more sustainable food choices (Camilleri et al., 2019; Muller, Lacroix, & Ruffieux, 2019; Vanclay et al., 2011; Vlaeminck, Jiang, & Vranken, 2014). Most of those studies investigated the impact of so-called carbon labels. Only the study

by Vlaeminck et al. (2014) has investigated the impact of an eco label that presents a summary sustainability score (from 1 to 10). However, that label was still quite detailed given that it also provided a colour evaluation of different environmental attributes.

The current research presents two online experiments into the impact of informational cues, i.e., eco labels and nutrition labels, on food choices. In the first study, we included an interpretative (simple) version of the eco label and of the nutrition label. In the second study, we also included a reductive (detailed) version of both label themes. We hypothesized that eco labels would lead to more sustainable eating choices compared to no labels. Furthermore, building on previous findings in the domain of nutrition labels (Hallez et al., 2020), and eco labels (Vlaeminck et al., 2014), we hypothesized that interpretative labels would lead to more sustainable choices compared to reductive labels, as well as compared to no labels.

2. Study 1

2.1 Materials and Methods

2.1.1 Design and procedure

The experiment included a choice task with an online web shop design. Participants were asked to choose ingredients and indicate quantities (in grams) for a one-person meal. They could choose among 30 products, which were presented with a name, a picture, a reference quantity, and with or without a label. Participants were randomly allocated to one of three conditions. Depending on the condition, the products were presented either with an interpretative nutrition label (i.e. the 'nutri-score label'), an interpretative eco label (the fictitious 'eco-score label') or without a label. The scores varied from A to E, and from green to red (see Figure 1).

Figure 1. Nutrition label (left) and Eco label (right)

2.1.2 Participants

Participants were 156 undergraduate students. After data cleaning, 142 young adult participants (Age: *M* = 20.64, *SD* = 1.59; 83.0% female) remained for data-analyses.

2.1.3 Measures

We calculated three sustainability values: the meat quantity (in grams), the total carbon footprint (in grams) and the total blue water footprint (in litres) of the participants' meals.

2.2 Results

A MANOVA revealed no significant impact of the labels on the meat quantity ($F(2,139) = .463$, $p = .63$, $\eta_p^2 = .007$), the carbon footprint ($F(2,139) = .929$, $p = .40$, $\eta_p^2 = .013$) or the blue water footprint ($F(2,139) = 1.37$, $p = .26$, $\eta_p^2 = .019$) of the meals.

2.3 Discussion

The findings of the first experiment revealed that participants did not make more sustainable choices when food products were displayed with eco labels compared to when they were displayed with nutrition labels or without labels. Similarly, the nutrition label (i.e., the nutri-score label) had no impact on the sustainability value of participants' food choices.

Regardless of the labels, participants made quite sustainable choices. For instance, more than one third (i.e., 36.6%) composed a meal without meat. These findings could be the result of self-selection bias. The participants in our sample were undergraduate students, and mostly female (i.e., 83%). A higher educational level and being female are both associated with a higher level of nutrition knowledge (Carbonneau et al., 2020). Previous studies have suggested that nutrition knowledge influences people's response to labels, for instance such that people with more nutrition knowledge prefer more detailed labels (Méjean, Macouillard, Péneau, Hercberg, & Castetbon, 2013). This may explain why our sample did not respond to the simple labels. A follow-up experiment is needed, in which labels with different levels of complexity are introduced, and in which participants' knowledge is taken into account.

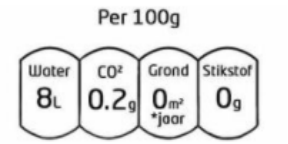
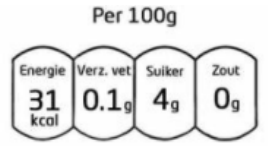
3. Study 2

3.1 Materials and Methods

3.1.1 Design and procedure

An experiment with a 2 (label theme: sustainability vs. nutrition) x 2 (label complexity: interpretative vs. reductive) plus 1 control group (no label) between-subjects design was conducted. Participants were randomly assigned to one of the five groups (see Table 1). The procedure was similar to the one used in study 1.

Table 1. Label stimuli in study 2

	Sustainability	**Nutrition**
Interpretative		
Reductive		

3.1.2 Participants

264 participants took part in the experiment. After data cleaning, 250 participants (Age: M = 21.81, SD = 1.54; 81.6% female) remained for data analyses. The majority (i.e., 86.8%) was highly educated.

3.1.3 Measures

The three sustainability outcomes, i.e., the meat quantity (in grams), the carbon footprint (in grams) and the blue water footprint (in litres), were calculated in the same way as in Study one. Additionally, we measured participants' subjective nutrition knowledge and subjective sustainability knowledge (Flynn & Goldsmith, 1999).

3.2 Results

A 2 x 2 MANOVA revealed a significant impact of the label theme (sustainability vs. nutrition) on the meat quantity ($F(1,190) = 4.55$, $p < .05$, $\eta_p^2 = .023$), the carbon footprint ($F(1,190) = 5.36$, $p < .05$, $\eta_p^2 = .027$), and the blue water footprint ($F(1,190) = 7.26$, $p < .01$, $\eta_p^2 = .037$). When compared to the control group, the eco labels had a significant impact on the meat quantity ($p < .05$), but not on the carbon ($p = .065$) or blue water footprint ($p = .088$). No significant difference occurred between the nutrition labels and the control group (p's > .05). Table 2 displays an overview of the sustainability values across label themes.

Table 2. The meals' sustainability values across label themes

Outcome	**Label theme**	**M**	**SD**	**N**
Meat quantity (in grams)	Eco labels	97.19	95.53	98
	Nutrition labels	127.91	107.52	96
	No Labels (control)	132.05	91.78	56

Carbon footprint (in grams)	Eco labels	3968.60	2474.59	98
	Nutrition labels	4763.11	2572.23	96
	No Labels (control)	4745.98	2426.59	56
Blue water footprint (in litres)	Eco labels	96.55	39.88	98
	Nutrition labels	111.30	42.06	96
	No Labels (control)	108.50	44.04	56

The 2 x 2 MANOVA revealed no significant impact of the label complexity (interpretative vs. reductive) on the meat quantity ($F(1,190) = .12$, $p = .73$, $\eta_{p^2} = .001$) or the carbon footprint ($F(1,190) = 2.11$, $p = .45$, $\eta_{p^2} = .011$). The impact of label complexity on the blue water footprint approached significance ($F(1,190) = 3.80$, $p = .053$, $\eta_{p^2} = .020$). No significant differences emerged when comparing both label complexities with the control group (p's > .05). Table 3 displays an overview of the sustainability values across label complexities.

Table 3. The meals' sustainability values across label complexities

Outcome	Label complexity	M	SD	N
Meat quantity (in grams)	Interpretative labels	111.21	100.27	99
	Reductive labels	113.63	105.38	95
	No Labels (control)	132.05	91.78	56
Carbon footprint (in grams)	Interpretative labels	4138.17	2328.74	99
	Reductive labels	4594.77	2751.39	95
	No Labels (control)	4745.98	2426.59	56
Blue water footprint (in litres)	Interpretative labels	98.92	36.06	99
	Reductive labels	108.98	46.18	95
	No Labels (control)	108.50	44.04	56

Regression analyses in Process Hayes revealed that the interaction term between the labels' complexity and nutrition knowledge approached significance with respect to the meat quantity ($t = 1.96$, $p = .051$). Specifically, compared to the control group, the interpretative nutrition label had a near-significant influence on people with high levels of nutrition knowledge ($t = 1.79$, $p = .07$) to choose less meat, but not on people with moderate ($t = .65$, $p = .51$) or low levels of nutrition knowledge ($t = -.94$, $p = .34$). No other significant interactions occurred with regards to the participants' nutrition or sustainability knowledge (p's > .05).

3.3 Discussion

Contrary to the results of the first experiment, the results of the second experiment suggest that (both simple and detailed) eco labels can influence more sustainable choices. Exposure to eco labels led participants to choose less meat compared to nutrition labels and to no labels. Eco labels also led to meals with a lower carbon and blue water footprint compared

to nutrition labels, but not significantly compared to no labels. Similar to study 1, the nutrition labels had no impact on the sustainability value of the meals. Interestingly, the label complexity (i.e., interpretative vs. reductive) had no impact on participants' food choices.

Given that Study 1 and Study 2 revealed mixed findings, we synthesized the data of both experiments (N = 392). This meta-analytical approach provides us with a weighted average that is more accurate than the average of individual studies (McShane & Böckenholt, 2017).

4. Aggregated results Study 1 and Study 2

4.1 Results

The results of a 2 x MANOVA revealed that the label theme (sustainability vs. nutrition) significantly impacted the meat quantity ($F(1,285) = 4.54$, $p < .05$, $d = .25$) the carbon footprint ($F(1,285) = 5.02$, $p < .05$, $d = .26$), and the blue water footprint ($F(1,285) = 5.71$, $p < .01$, $d = .31$) of the meals. Specifically, the eco labels influenced more sustainable choices than the nutrition labels. There were no significant differences between the eco labels and the control group, or between the nutrition labels and the control group (p's > .05). Table 4 presents an overview of the aggregated sustainability values across label themes.

Table 4. The aggregated sustainability values across label themes

Outcome	Label theme	M	SD	N
Meat quantity (in grams)	Eco labels	91.85	93.04	146
	Nutrition labels	111.60	102.97	143
	No Labels (control)	101.50	94.38	103
Carbon footprint (in grams)	Eco labels	3910.49	102.97	146
	Nutrition labels	4434.94	2455.55	143
	No Labels (control)	4070.82	2414.34	103
Blue water footprint (in litres)	Eco labels	99.73	42.51	146
	Nutrition labels	112.23	46.38	143
	No Labels (control)	103.17	47.07	103

The 2 x 2 MANOVA also revealed a significant impact of the label complexity (interpretative vs. reductive) on the carbon footprint ($F(1,285) = 5.22$, $p < .05$, $d = .27$), such that the interpretative labels influenced participants to compose meals with a lower carbon footprint compared to the reductive labels. In contrast, the label complexity had no significant impact on the meat quantity ($F(1,285) = 2.66$, $p = .10$, $d = .19$) or the blue water footprint ($F(1,285) = 1.04$, $p = .30$, $d = .12$). There were no significant differences between the label groups and the control group (p's > .05). Table 5 displays an overview of the aggregated sustainability values across the label complexity groups.

Table 5. The aggregated sustainability values across label complexities

Outcome	Label complexity	M	SD	N
Meat quantity (in grams)	Interpretative labels	95.74	94.54	194
	Reductive labels	113.63	105.37	95
	No Labels (control)	101.50	94.38	103
Carbon footprint (in grams)	Interpretative labels	3961.98	2207.66	194
	Reductive labels	4594.76	2751.39	95
	No Labels (control)	4070.82	2414.34	103
Blue water footprint (in litres)	Interpretative labels	104.41	44.19	194
	Reductive labels	108.98	46.18	95
	No Labels (control)	103.17	47.07	103

5. General Discussion

Two studies investigated the impact of informational cues, i.e., eco labels and nutrition labels, in an online choice task. The studies provided mixed results; whereas the first experiment showed no effect of labels, the second experiment revealed that eco labels caused more sustainable eating choices. To resolve these mixed results, we synthesized the data from both experiments. The aggregated results revealed that eco labels led to more sustainable choices compared to nutrition labels, but not compared to no labels. Moreover, contrary to the findings of the second experiment, the aggregated results revealed an impact of the label's level of complexity. Specifically, the interpretative labels influenced participants to compose meals with a lower carbon footprint compared to the reductive labels.

Interestingly, we found no effect of the nutri-score label on the environmental (nor on the nutritional) value of food choices. This non-finding conflicts with previous experimental studies that reported that this label can influence eating intentions (De Temmerman et al., 2020), and choices (Poquet et al., 2019). One reason why we only found an effect of eco labels might be that consumers seem to favour eco labels over nutrition labels (Tobi et al., 2019).

We realize that our studies are not without limitations. An important first limitation is the possibility of self-selection bias due to the use of non-probability, convenience samples. The findings are also limited by the fact that participants made hypothetical choices. Finally, the design included both existing (i.e., the nutri-score label) and fictional labels. Unfortunately, we did not measure whether participants understood the different labels.

In the future, there should be more empirical investigations into the effectiveness of eco labels differing in complexity. These studies should include a more varied sample with more male participants, and participants with varying levels of knowledge and educational status.

Furthermore, since our experiments were among the first to investigate the impact of the nutri-score label on food choices, more empirical research on this topic is warranted.

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