Sustainability labels: a key component of food quality?

Impact of food-processing information on the appreciation of bread

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ABSTRACT

The environmental problem is causing growing concerns and the food industry is sometimes perceived as one of the main contributors to environmental degradation. But, at the same time, the rapidly growing world's population requires increased food production. In addition, the industry is becoming more environmentally conscious and so food companies are looking for new processes, called "clean processes," to reduce energy use, water consumption, CO_2 emission and waste generation, as well as decreasing production cost.

In parallel, consumers in a purchase situation are exposed to various types of information such as brand, price, packaging, product origin, nutritional values, etc., often mentioned by claims or labels. The question that naturally arises is: Is it necessary to communicate with consumers about the notion of clean food-processing? And if so, would this information modify their product quality perception?

The aim of this study was to explore the influence of communication about food-processing environmental impact on the global liking of food products for French consumers and to investigate the link with their knowledge about sustainability and behavior. To address this issue, a consumer test with two different industrial breads in two conditions (one blind and one with a food-processing labelling) was carried out with 209 consumers. At the end of the test, participants were administrated a questionnaire to assess their general knowledge and behaviors related to sustainability. Results show that the most preferred product in blind condition was perceived as better when presented with a clean process label, and was not affected by an energy-consuming process label. Conversely, the least liked product was not affected by a clean process label but was depreciated by a negative one.

These results suggest that the quality perceived by the consumer can be influenced by labelling products with information about sustainably.

***Keywords**: sustainability, clean food-processing, hedonic test.*

1. INTRODUCTION

In 2002 the United Nations World Summit on Sustainable Development in Johannesburg declared that "fundamental changes in the way societies produce and consume are indispensable for achieving global sustainable development. All countries should promote sustainable consumption and production patterns." Food production and consumption are mainly concerned by these recommendations. Indeed the food industry is a large user of key resources: water, raw material, and energy. At the same time, the demand for food is growing because of the rapid growth of the world's population and the increasing affluence of emerging economies such as China and India. From an industrial point of view, the challenge for factories is to continue to achieve economic success whilst saving energy, limiting the environmental footprint of industrial processes, and reducing the wastes produced during the transformation process. From a consumer point of view, changes in consumption behavior imply that consumers have the necessary information available to help them to make more sustainable food choices. There is an increasing public awareness of the environmental impact of food consumption. Even if food price and consumer income are still playing a key role in influencing the purchasing decisions of food consumers, the sustainable manner by which the food products has been manufactured is becoming a food quality attribute, in the same way as safety, health, nutrition, taste, or convenience [1]. According to a survey by the European Commission in 2012, 84% of European citizens said that the product's impact on the environment is "very important" or "rather important" when making purchasing decisions. This puts the environment in the third place among product attributes that consumers say influence their purchasing decisions, after quality (97%) and price (87%). In addition, more than three-quarters of respondents were willing to pay more for environmentally-friendly products if they were confident that the products are truly environmentally-friendly (77%).

Aware of all these issues, public authorities are urging food companies to develop sustainable strategies and to communicate about it to the consumers. This is why environmental labelling is the target of increasing scientific and general public studies dealing with the best ways to set up this new sustainable communication tool. The dual purpose of this action is to include an environmental component in consumer purchasing choices and to provide the entire food production and distribution chain with new indicators to promote and intensify their efforts to produce more sustainably. The problem is that consumers (48% of the European citizens) are confused by the stream of incomparable and diverse environmental information and only just over half of them generally trust producers' claims about the environmental performance of their products [2]. In this context and to tackle the problem of fragmentation in the provision of environmental information, the European Commission has introduced the Single Market for Green Products initiative in April 2013. The initiative advises companies to adopt the Product Environmental Footprint (PEF) in order to provide consumers with reliable information that can be compared with information provided by other companies. These methods are based on Life Cycle Assessment (LCA), a tool that strives to identify the environmental impacts of a product over its entire life, from the extraction of raw materials to the end of life of the product.

In this context, the scientific community is examining the different angles of sustainable consumption and tries to understand the results of the public surveys on food consumer's perception of

sustainability labelling. The two most studied sustainability labels are Fair Trade and organic ones, using a very large range of products, *e.g.* coffee [3,4], yogurts [5,6], chocolate [7], cheese [8], meat [9,10], bread [11], eggs [10,12], pineapple [13] or beer [14]. A part of this literature focuses on food consumers' understanding of sustainability concept and/or labels [15-22]. In summary, these studies suggest that, for most people, sustainability is quite an abstract notion that refers more to the environmental dimension than to the ethical dimension. There are large differences the information provided by sustainability labels, some being better self-explanatory than others (Carbon footprint and Animal welfare). Moreover, familiarity with these labels seems to be important for the consumers' confidence but is not necessarily correlated with a better understanding of the meaning of the label. A lot of studies focused on willingness to pay for sustainability labelled food products (*e.g.*, De Pelsmacker, et al. [4]; Kimura, et al. [23]; Loureiro and Lotade [3]; Napolitano, et al. [8]; Napolitano, et al. [9]; Gil, et al. [10]; Lee, et al. [6]; Pomarici and Vecchio [15]; Didier and Lucie [7]; Zander and Hamm [12]). Despite the variety of studied labels and products, the general trend from the results is that consumers are willing to pay more for products presented with a sustainability label. However, this global effect depends on several parameters, especially the label by itself [3,7,15], the product and the consumers' attitudes towards sustainable issues [10]. Conversely, fewer studies deal with this issue of perception of sustainability food labels by introducing a tasting phase in their experimental design in order to evaluate the effect of sustainability information or label on consumers' liking [5,6,8,9,11,13,14,24,25]. Conclusions are globally the same as for willingness to pay: whatever the product (e.g., yogurt, pineapple, bread, tomatoes), a sustainability label enhanced the liking of the product. Most of the time, liking is measured in three conditions—blind, expected and informed—and the results are interpreted in terms of confirmation or disconfirmation of the hedonic expectation [26,27]. As for the willingness to pay for sustainability labelled food products, the results can also vary according to consumers' sensitivity to sustainable issues. For example, Laureati, et al. [5] found that non-sustainable consumers had a better appreciation of non-organic yogurts compared to organic yogurts whereas sustainable consumers evaluated organic and conventional yogurts in the same way.

Today, environmental efforts made by the food industry do not concern anymore only organic or Fair Trade productions but each of the different sub-processes that use resources and produce unwanted outputs. Many food industries opt for more green technologies to produce their products such as the use of enzymes as biological catalysts, microwave, radio-frequency heating or high pressure processing instead of thermal treatments for microbiological control or else elimination of drying operation that is very energy-consuming [28]. Either because they are forced to by legislations or as a direct result of the own initiatives, an increasing number of food industrials evaluate their activities in order to report, improve and market their environmental efforts. In this context, one can ask if it is valuable for food companies to communicate to consumers about their use of green food manufacturing processes and if this kind of information would modify the quality perception of the food products by consumers as it is the case for organic or Fair Trade information. To address these issues, a hedonic test on sandwich breads was carried out in two conditions (blind and with a food-processing label). So we tested whether informing the consumers about the positive or negative environmental impact of the food manufacturing technology used to produce the

sandwich breads they tasted could modify their liking degree of the products. The same consumers were also administrated a questionnaire devised to explore their general knowledge and behaviors related to sustainability, with the aim to explore whether these factors could influence the hedonic ratings.

2. MATERIALS AND METHODS

2.1 Assessors

Two hundred and nine (129 females and 80 males) participants aged between 18 and 76 years (M = 41.1; SD = 14.6) were recruited among a database of consumers living in Lille (France) and its suburbs. No specific recruitment criterion was used.

2.2Products

Two commercial industrial breads were used as experimental samples (Regular American Sandwich, Harrys and Regular Special Sandwich, McEnnedy, Lidl). Products were purchased in a local supermarket and for a given brand all samples were chosen from the same batch and across the two brands the difference in shelf-life was no more than four days. Bread samples were stored and served at room temperature. For the tasting phase, bread slices were divided into four squares and one sample corresponded to a quarter of slice.

2.3 Procedure

2.3.1 Hedonic test

Assessors took part individually in the test in a single session lasting around 20 min. The test was conducted in the sensory laboratory of the ISA Group (Lille, France) designed according to ISO guidelines [29]. Data were collected using a form built with Google Drive 2014 (Google Inc., Mountain View, United States).

The two toast breads were first evaluated under blind condition and then under informed condition. Assessors were first asked to rate the liking degree of the two products under blind condition (*i.e.*, without any information about the product) using an unstructured scale ranging from 0 (I don't like it at all) to 10 (I like it a lot). Then, using the same scale, the assessors were asked to rate their liking degree of the two products, presented two times each: one time with a "positive" food-processing label (Figure 1a.) and one time with a "negative" food-processing label (Figure 1b.). The labels were shown on a screen, with the following sentence: "Below is the environmental classification of the manufacturing process of sliced bread #123. This classification represents energy and water consumption, and CO_2 emissions." The assessors were not informed that there were only two products they tasted several times.

The presentation order of the samples was balanced among the assessors for the blind condition on the one side and for the informed condition on the other side according to a Latin Square. Mineral water was available for assessors to rinse between samples.

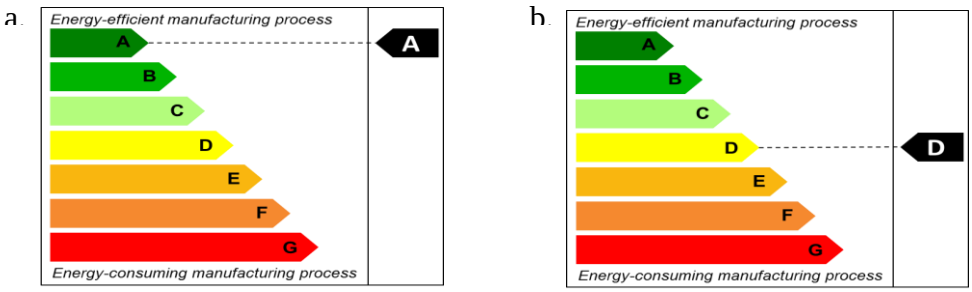

Figure 1. Positive (a.) and negative (b.) food-processing label

2.3.2 Questionnaire

At the end of the tasting phase, assessors were administered a questionnaire designed to evaluate their behavior and their general knowledge about sustainability. The questionnaire was inspired from other surveys searching for the same objectives [5,16,22] and designed to be answered in no more than 10 minutes. The structure of the questionnaire could be divided in 5 different parts (a through e) as follows: a) demographic questions, b) consumption habits of toast bread, c) criteria of food choice, d) declarative sustainable behavior and e) knowledge about sustainability. Each section is detailed below.

a) For the demographic characteristics consumers were presented six closed questions asking about gender, age, occupation, number of people in their household and number of children.

b) For consumption habits, the questions were: Do you personally eat sliced bread? If so, how often do you eat sliced bread?, How often do you buy sliced sided bread for your household? At what time of the day do you eat sliced bread? [possible answers: at breakfast, alongside my meals (except breakfast), as a snack, as a nibble for aperitif, as a sandwich, as a toastie or croque-monsieur].

c) To evaluate the importance of different criteria for food choice, the assessors were asked to give the degree of importance of 20 attributes (see Table 2) when shopping for groceries, by choosing between *not at all important*, *slightly important*, *important* and *very important* for each of them.

d) For declarative sustainable behavior, the assessors answered the following question: "Over the 3 last months, how often have you performed the following actions?" For 19 different actions (see Table 3), they chose the frequency among *Never*, *Rarely*, *Sometimes*, *Often* and *Always*.

e) To explore assessors' general knowledge about sustainability, assessors answered 10 multiple-choice questions choosing to cover all the aspects of this notion.

3. RESULTS

3.1 Global panel: hedonic test

Data from the hedonic test were first analyzed for the whole panel (209 assessors, Figure 2) using a three-factor analysis of variance (ANOVA) on the hedonic ratings to evaluate the effect of assessor, product (*Harrys* vs. *Lidl*), label (*without* vs. *positive* vs. *negative*) and the two-way interaction product × label. These three factors were entered in the model as within-subject variables.

This analysis revealed significant effects for all the factors and for the interaction (Table 1). The Harrys product (M = 6.48 ± 2.03) is globally more appreciated than the Lidl product and products with the positive label (M = 6.21 ± 2.17) obtained better marks than products with the negative label (M = 5.81 ± 2.18) or without any label (M = 5.62 ± 2.23). Because the interaction product × label was significant, two two-factor ANOVAs were carried out with assessor and label (*without* vs. *positive* vs. *negative*) as factors and the hedonic ratings as dependent variable for Harrys and for Lidl respectively. Both ANOVAs showed significant effects of the label factor [$F(2,416) = 35.56$, $p < .0001$ for Harrys; $F(2,416) = 3.64$, $p < .0001$ for Lidl]. Harrys bread with the positive label (M = 7.02 ± 1.77) was more appreciated than when presented with the negative label (M = 6.60 ± 1.93), which was itself more appreciated than when presented without any label (M = 5.81 ± 2.18). For the Lidl bread, there was no difference of appreciation between the positive label (M = 5.43 ± 2.27) and the presentation without any label (M = 5.39 ± 2.23) but both obtained

better marks than the negative label (M = 5.02 ± 2.12).

Table 1. Results of the three-way ANOVA

Factor	F *(df factor/df error)*	p
Assessor	3.19 *(208/1040)*	< .0001
Product	141.18 *(1/1040)*	< .0001
Label	11.76 *(1/1040)*	< .0001
Interaction product×label	16.21 *(2/2040)*	< .0001

3.2 Global panel: questionnaire

3.2.1 Self-reported food choice criteria

The mean score of the assessors to the question "When shopping for groceries, which criterion are important to you?" (with 0 = "Not at all important", 1 = "Slightly important", 2 = "Important" and 3 = "Very important") are given in Table 2. The results revealed that taste is the most important purchase criterion with 99% of the respondents declaring that this item is important or very important. Then come quality (97.1%), food safety (88.5%) and price (88.0%). Sustainability items are less important, the first one—methods of raising animals—coming at the 11th place out of 20 items with 64.% of the respondents considering it as important or very important. Then come country of origin (62%), ability to recycle the packaging (57%), environmental (59%) and ethical (58%) impacts which are not major factors in consumers' purchasing decision, as well as organic status of the food products which is the second to last criterion with only 44% of the assessors declaring that it is important or very important.

Table 2. Self-reported food choice criteria. (N = 209)

"When shopping for groceries, which criteria are important to you? Indicate the degree of importance on the scale below."
0 = "Not at all important" and 3 = "Very important".

Criterion	Mean	Std. Deviation
Taste	2.76	0.49
Quality	2.64	0.57
Best before / use by date	2.38	0.76
Food safety	2.31	0.71
Price	2.31	0.74
Health and nutritional benefits	2.20	0.72
Ingredients list	2.02	0.80
Nutritional values	1.93	0.82
Ease	1.91	0.67
Quantity/size of products	1.88	0.78
Methods of raising animals	*1.80*	*0.93*
Familiar product	1.77	0.79
Country of origin	*1.73*	*0.91*
Ability to recycle the packaging	*1.69*	*0.93*
Brand	1.69	0.86
Environmental impact	*1.67*	*0.87*
Ethical impact	*1.61*	*0.81*
Allergy information	1.59	1.07
Organic status	*1.35*	*0.95*
Cooking instructions	1.33	0.90

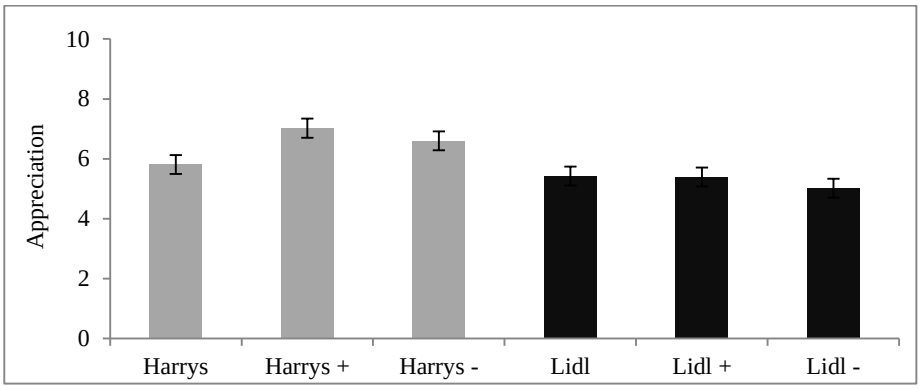

Figure 2. Mean hedonic ratings and error standard for the 209 assessors for Harrys and Lidl products when presented without any label, with the positive label (+) and with the negative label (-)

3.2.2 Declarative sustainable behavior

The mean scores of the consumers to the question "Over the 3 last months, how often have you perform the following actions?" (with 0 = "Never," 1 = "Rarely," 2 = "Sometimes," 3 = "Often," and 4 = "Always") are reported in Table 3. As shown, "Recycling waste" is the most regular sustainable action with 94% of the respondents declaring that they often or always recycle their waste. The next two actions regularly performed by the consumers are buying seasonal products and switching off appliances with standby (respectively 78% and 71% of the respondents declared to have performed these two actions often and always over the last three months). We can observe that the four non-sustainable actions (NS in Table 3) are among the less performed ones. Only 10% of the respondents declared buying often or always exotic food over the last three months and less than 30% of them have taken a bath, used a clothes dryer or left the TV on standby.

3.2.3 Sustainability knowledge

Concerning the sustainability knowledge of the respondents, Table 4 shows that scores vary from 28% to 90% of correct answers, indicating a quite large variability in the questions' difficulty. This variability is interesting for categorizing respondents according to their knowledge of the sustainability notions.

Table 3. Self-reported sustainable behavior (N=209)

"Over the 3 last months, how often have you performed the following actions?"

0 = "Never", 4 = "Always"; S = sustainable action, NS = non-sustainable action

Actions	Mean	Std. deviation
Recycling waste (S)	3.65	0.73
Buying seasonal products (S)	2.97	0.77
Switching off appliances with standby (S)	2.93	1.05
Civering the pot when boiling water (S)	2.80	1.37
Using the paper on both sides (S)	2.78	1.09
Buying local food (S)	2.53	0.87
Using public transportation (S)	2.52	1.29

Taking back your unused or expired pharmaceuticals to a pharmacy (S)	2.38	1.53
Giving or reselling unused objects which still work (S)	2.33	1.12
Avoiding GMO food (S)	1.95	1.43
Buying eco-refills (S)	1.85	1.16
Eating organic food (S)	1.67	1.06
Buying exotic food (NS)	*1.65*	*0.76*
Avoiding preservatives in food (S)	1.56	1.18
Leaving the TV on standby (NS)	*1.50*	*1.44*
Buying Fair Trade products (S)	1.48	1.01
Using a clothes dryer (NS)	*1.47*	*1.42*
Refuse junk mail and advertising circulars (S)	1.43	1.58
Taking a bath (NS)	*1.33*	*1.28*

Table 4. Percentages of correct answers to the 10 sustainability knowledge questions (N=209)

Questions	Correct answers (%)
Is petrol a renewable energy?	90.0%
According to you, Fair Trade is mostly relevant to which type of product?	83.7%
What did the countries who signed the Kyoto protocol agreed to do?	83.3%
Deforestation contributes to climate change because…	77.5%
When recycled, plastic containers and transparent bottled can be turned into…	72.7%
What are the 3 pillars of sustainability?	62.7%
Which product requires 33 000 liters of water for its manufacture?	59.3%
How many wind turbines are needed to reach the power of a small nuclear power station?	49.3%
How many humans suffer of malnutrition around the world?	34.0%
What proportion of house refuse is made of packaging?	28.2%

A Pearson's correlation coefficient calculated between the assessors' age and the sustainability knowledge score (r = –0.218, p = .002) indicates that younger consumers have more knowledge about sustainability than older consumers. No correlation between assessors' sex and sustainability knowledge was found.

3.2.3 Relation between food choice criteria, sustainable behavior and sustainability knowledge

In order to find whether a relation existed between the three measures of sustainability sensitivity of the questionnaire (food choice criteria, sustainable behavior and sustainability knowledge), we first computed a new score for the food choice criteria parameter and for the sustainable behavior. For the food choice criteria, we considered only the six sustainable food choice criteria, namely *country of origin*, *methods of raising animals*, *ability to recycle the packaging*, *environmental impact*, *ethical impact* and *organic status*, and for each assessor we computed the mean score over these six criteria. So, the higher the food choice score, the more the assessor has a sustainable behavior regarding this point. For sustainable behavior, we re-calculated the mean score over the 19 proposed actions for each assessor by inversing the score of the four non-sustainable actions (buying exotic food, taking a bath, leave the TV on standby, using a clothes dryer). So here again, the higher the behavior score, the more sustainable the assessor reported to be. No transformation was made for the knowledge score

which conveys the knowledge level of the assessors. The higher this score, the more the assessor knows about sustainability. Then Pearson's correlation coefficients were computed between these three new scores two by two. The food choice score and the one concerning the sustainable behavior are highly correlated (r = .702, p < .0001) a pattern meaning that assessors who declared that sustainable food choice criteria are important for them also self-reported regularly perform sustainable actions. On the contrary, there is no correlation between the knowledge score and neither the food choice score (r = .014, p > .05) nor the behavior score (r = .059, p > .05).

Besides, Pearson's correlation coefficients calculated between the assessors' age on one hand and the self-reported food choice criteria score (r = .311, p < .0001), and sustainable behavior score (r = .234, p = .001) on the other hand, showed that older consumers are more sensitive to sustainability than younger consumers, with a larger importance of sustainable food choice criteria and more sustainable actions. Moreover, women report having more sustainable actions than the men [F(1,197) = 19.93, p < .0001].

3.3 Assessors' segmentation according to the global sustainable behavior

Because food choice scores and sustainable behavior score were correlated, we fused in a unique score now called *global sustainable behavior* (GSB), considering that the food criterion reported by the assessors conveyed their behavior in a purchasing situation. The GBS score was calculated as the mean of the food choice and the behavior scores, both rescaled to a maximum of 10, for each assessor. Then we categorized the assessors into three subgroups according to their GSB, using the same method as Laureati, et al. [5]. The assessors with a GSB score within the 25th percentile of the distribution (Q_1 = 4.46/10) were defined as "non-sustainable" (54 assessors), the ones with a GSB score over the 75th percentile (Q_3 = 6.89) were defined as "sustainable" (55 assessors) whereas the rest of the assessors were defined as "uncertain" (100 assessors). Then the hedonic ratings of sandwich breads were computed for each group (Figure 3) with a four-factor ANOVA considering *assessors* (nested within GSB level), *GSB level* (non-sustainable, uncertain and sustainable), *product* (Harrys and Lidl), *label* (without, positive and negative) and the two two-way interactions *product* × *GSB level* and *label* × *GSB level* as factors and hedonic scores as dependent variable.

ANOVA results showed a significant effect of the product [F(1,1038) = 276.33, p = .0018] and of the label factors [F(2,1038) = 9.92, p = .0001] but no interaction are significant, confirming the observations of the Figure 3 and indicating that the GSB level has no effect on the hedonic appreciation of sandwich breads.

3.4 Assessors' segmentation according to the sustainability knowledge level

Assessors were then grouped in three groups according to their sustainability knowledge score according to the same method as for the GSB score. The assessors with a sustainability knowledge score within the 25th percentile of the distribution (Q_1 = 5/10) were defined as "non-connoisseur" (60 assessors), the ones with a score over the 75th percentile (Q_3 = 8/10) were defined as "connoisseurs" (53 assessors) whereas the rest of the assessors were defined as "uncertain" (96 assessors). The hedonic ratings of sandwich breads for each consumers' group are shown Figure 4. To study the influence of the sustainability knowledge level on the appreciations, we carried out a four-factor ANOVA

considering *assessors* (nested within sustainability knowledge level), *sustainability knowledge level* (non-connoisseurs, uncertain and connoisseurs), *product* (Harrys and Lidl), *label* (without, positive and negative) and the two two-way interactions *product* × *sustainability knowledge level* and *label* × *sustainability knowledge level* as factors and hedonic scores as dependent variable.

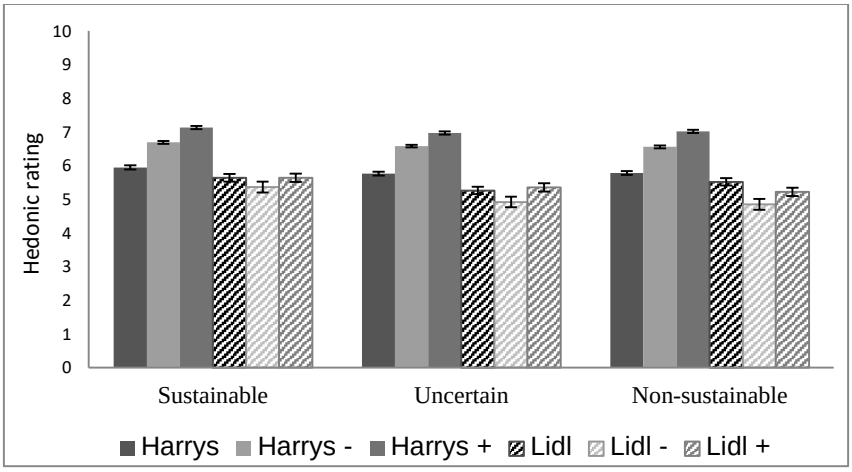

Figure 3. Mean hedonic ratings and standard errors of the sustainable, uncertain and non-sustainable groups of consumers for Harrys and Lidl products when presented without any label, with the positive label (+) and with the negative label (-).

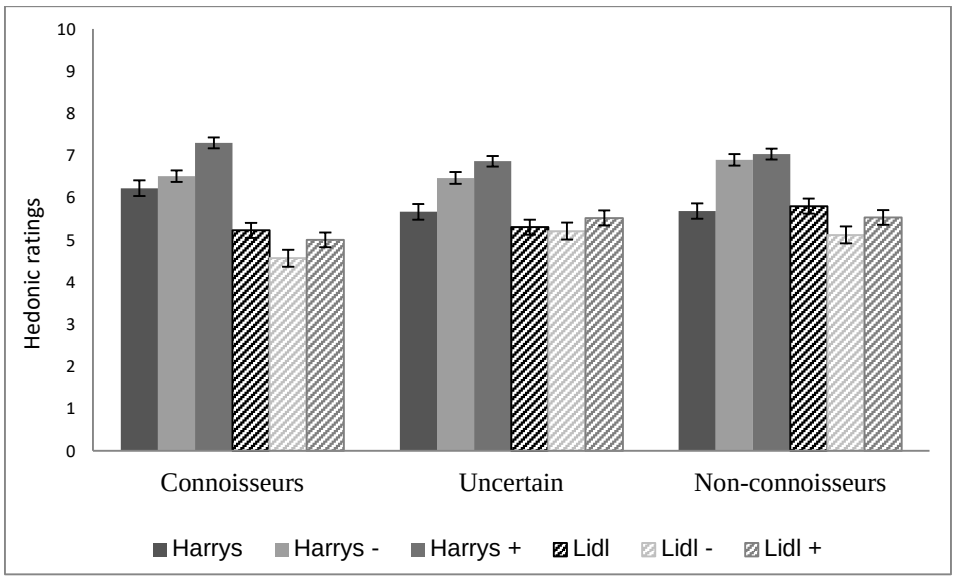

Figure 4. Mean hedonic ratings and standard errors of the connoisseurs, uncertain and non-connoisseurs groups of consumers for Harrys and Lidl products when presented without any label, with the positive label (+) and with the negative label (–).

The results showed a significant effect of interaction *product* × *sustainability knowledge level* [$F(1,1038) = 16.08$, $p = .0075$]. Whatever the label, the connoisseurs globally appreciated the Harrys bread ($M = 6.68$) more than the uncertain ($M = 6.33$) and non-connoisseur consumers ($M = 6.53$) and conversely, they appreciated less the Lidl bread ($M = 4.93$) than the two other consumers' groups ($M =$

5.34 for uncertain and *M* = 5.48 for non-connoisseurs). The *label* × *sustainability knowledge level* interaction was no significant, indicating that the level of sustainability knowledge do not influence the way the consumers perceived the label.

4. DISCUSSION

The aim of the present study was to evaluate the influence of information on the environmental impact of the food manufacturing process on the appreciation of a convenience food (*i.e.,* sandwich bread). This kind of approach has been already used to study consumers' perception of different sustainability labels, especially organic and Fair Trade labels (*e.g.*, Laureati, et al. [5]; Loureiro and Lotade [3]; Napolitano, et al. [8]; Napolitano, et al. [9]; Poelman, et al. [13]). In an International and European context of sustainable development, public authorities as well as consumers are increasingly demanding for clear communication on the environmental impacts of the food products. Then the kinds of information to communicate as well as the way to do it are important issues for food industrials. The food manufacturing process is an important step in the production of a food item and is more and more progressing by introducing green technologies which help reducing the needed resources and the unwanted waste. However, this production step is unknown by the food consumers, so studying the impact a communication on environmental impact of the food processing on the appreciation of consumers has a great interest for industrials, as well as for consumers and public authorities.

The first important result is that taste remains an important factor for consumers liking of sandwich bread. Even when presented with a negative environmental information (negative label), the Harrys bread is not less appreciated than when presented in blind condition (without any information). This effect was already found by other authors [1,7,11] and is supported by the results of the question on the food choice criteria when shopping for groceries. Taste stands out as the most important criterion for the consumers, at the quite same level as quality. However, when presented with a positive label, the Harrys bread sees its hedonic mark improved compared to the blind condition, and conversely, the hedonic score of the Lidl bread presented with a negative label is lower than in blind condition. These results indicate that the information about environmental impact of the food-processing influences consumers' liking, either by improving it when the product is perceived as good or by decreasing it when the product is perceived as less good. This is not completely in accordance with previous results on tomatoes, showing that the best liked tomatoes maintained their hedonic scores while the least liked tomatoes scored higher for liking when declared to be ecologically grown [24].

When studying the hedonic scores by groups of assessors, no difference of liking appears between the groups, that the categorization was made according to their sustainability knowledge level or to their global sustainable behavior. This result is not in the same way as previous studies which observed an influence of the engagement in environmentally friendly activities on the perception of sustainability-labelled food products [6,10,11,15,16]. Laureati, et al. [5] showed that sustainable consumers have a higher expectation towards organic yogurts than non-sustainable assessors. Gil, et al. [10] found that only likely (*i.e.* concerned with natural food consumption, life equilibrium and health care) and actual organic food consumers showed positive attitudes towards organic foods and were willing to pay a premium for them. Also Kihlberg, et al. [11] observed that consumers reporting the highest frequency of buying organic food showed the highest enhancement of

liking when informed that the tasted sample had organic origin. Similar effects were found by Schuldt and Hannahan [30] who observed that participants low in environmental concern perceive organic products as having inferior taste quality. Our results could be due to our questionnaire which does not allow discriminating sufficiently between the sustainable behavior and sustainability knowledge of our consumers. However, other works (*e.g.*, Laureati, et al. [5]; Schuldt and Hannahan [30]) have observed difference between consumers' perception of sustainability labeling food products with the same kind of questionnaire. Another believable explanation is linked to the nature of the environmental information itself. The way foods are processed to transform raw materials into value-added foods and ingredients is unknown to the consumers. So it is likely that the assessors did not understand to what notion the food-processing label referred to, especially as no information concerning food process is communicated to the food consumers at the moment. Moreover, although French consumers are familiar with the energy label which is affixed to household appliance since 1995, this logo is not used for food products, conversely to Fair Trade, organic, Rainforest Alliance logos or various carbon index schemes.

Finally, the answers to the questionnaire highlight results in agreement with the literature, especially the fact that recycling waste is the most cited sustainable actions, as previously found by Laureati, et al. [5] and Gil, et al. [10]. Also we found that respondents' sustainability knowledge is not linked to their reported sustainable behavior. This is not because consumers have theoretical knowledge on sustainability notions that they act in a sustainable manner in the everyday life. This result has been already found by others authors [31,32]. Redman and Redman [33] refined that declarative knowledge alone do not predict increased participation in sustainable behaviors while procedural and social knowledge are good predictors of sustainable food behaviors. Moreover, we found that older consumers declared to be more engaged in sustainable actions, as previously reviewed by Wiernick, Wiernik, et al. [34] who indicated that older individuals appear to be more likely to engage with nature, avoid environmental harm, and conserve raw materials and natural resources. Gender is another socio-demographic variable that influences sustainable behavior as we found that women declared more environmental behavior than male, as previously showed by Awan and Abbasi [35] or Zelezny, et al. [36], but conversely to Tan and Lau [37].

To conclude, the present experiment corroborates previous studies showing that sustainability labels are not major criteria in consumers' food choice. From a marketing point of view, a green label could be an attractive feature for consumers but only if the food item shows a good sensory quality originally. Moreover, the application of these sustainability labels on the food products will certainly require to be accompanied by a communication campaign to explain the label signification and origin to the consumers, as some environmental impacts of the products (*e.g.* food manufacturing process impacts) are more difficult to comprehend than others.

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Thông tin về sự phát triển bền vững trên nhãn hiệu: một yếu tố then chốt của chất lượng thực phẩm

Tìm hiểu tác động của thông tin chế biến thực phẩm đến giá trị của sản phẩm bánh mỳ

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TÓM TẮT

Mức độ tác động đến môi trường là vấn đề đang được quan tâm và ngành công nghiệp thực phẩm có thể là một trong những tác nhân chính gây ảnh hưởng đến môi trường. Tuy vậy, công bằng mà nói, chính sự tăng nhanh của dân số thế giới đòi hỏi sản lượng thực phẩm cũng phải tăng ở mức tương ứng. Bên cạnh đó, các ngành công nghiệp sản xuất nói chung đang dần nâng cao ý thức về môi trường, và ngành sản xuất thực phẩm nói riêng cũng đang nỗ lực tìm kiếm những quy trình mới, quy trình sản xuất sạch (clean processes), nhằm giảm thiểu nguồn năng lượng, nguồn nước, khí thải CO_2, rác thải, cũng như giảm chi phí sản xuất. Trong bối cảnh đó, khi người tiêu dùng mua sản phẩm thực phẩm, họ có điều kiện tiếp xúc với nhiều thông tin như: thương hiệu, giá cả, bao bì, nguồn gốc, giá trị dinh dưỡng, vv., những thông tin này thường được ghi chú bắt buộc theo quy định hoặc theo nhãn hiệu công bố. Một câu hỏi được đặt ra là: Có cần thiết cung cấp cho người tiêu dùng khái niệm về sản xuất thực phẩm sạch hay không? Nếu được cung cấp, liệu thông tin này có làm gia tăng chất lượng sản phẩm?

Mục đích của nghiên cứu này nhằm tìm hiểu sự ảnh hưởng của việc cung cấp thông tin (về mức độ tác động đến môi trường của quy trình sản xuất thực phẩm) lên thị hiếu của sản phẩm, và nghiên cứu mối quan hệ giữa mức độ tác động đến môi trường với kiến thức của người tiêu dùng về sự phát triển bền vững và hành vi. Để đạt được mục đích nghiên cứu trên, một phép thử người tiêu dùng (consumer test) được thực hiện trên hai loại bánh mì công nghiệp trong hai điều kiện (mẫu được mã hóa và mẫu được ghi nhãn về quy trình sản xuất), phép thử được thực hiện trên 209 người tiêu dùng Pháp. Sau khi hoàn thành phép thử, người tiêu dùng được yêu cầu trả lời một bảng câu hỏi để đánh giá kiến thức tổng quan và hành vi của họ liên quan đến 29 sự phát triển bền vững.

Kết quả chỉ ra rằng các sản phẩm được ưa thích hơn trong điều kiện mã hóa sẽ được đánh giá có chất lượng cao hơn nếu được ghi nhãn có quy trình sản xuất sạch, và mức chất lượng không thay đổi nếu sản phẩm bị ghi nhãn có quy trình sản xuất tiêu tốn năng lượng. Ngược lại,

đối với các sản phẩm ít được ưa thích hơn, chất lượng sản phẩm không gia tăng khi được ghi nhãn có quy trình sản xuất sạch, nhưng bị đánh giá có chất lượng thấp khi bị ghi nhãn có quy trình sản xuất tiêu tốn năng lượng.

Những kết qua thu được như trên gợi ý rằng chất lượng sản phẩm được cảm nhận bởi người tiêu dùng có thể bị ảnh hưởng bởi việc ghi nhãn sản phẩm liên quan đến thông tin về sự phát triển bền vững.

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