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## **Can information affect sensory perceptions? Evidence from a survey on Italian organic food consumers**

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**Abstract:** This paper aims to investigate the influence of information on consumers' preferences and sensory perceptions of organic food using a sample of 301 Italian organic food consumers. Consumers stated their preferences for “core organic” attributes, labels and information on food products and performed blind and informed tests on strawberry yoghurts and cookies. Data were analysed using descriptive analysis, Mann-Whitney U tests and Wilcoxon signed-rank test. Results revealed that consumers appreciate “core organic” attributes, like artisanal production and variability of sensory attributes. Comparing blind and informed tests, results showed that information affects the overall liking of products and consumers' perception of product-specific sensory attributes. However, the influence of information on sensory perceptions depends on the product category, sensory attributes and the type of information provided.

**Keywords:** organic food; Italy; consumer; sensory test; sensory marketing; labels; information

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### **1. Introduction**

Food choice is one of the most frequent human activity that consumers do every day, and it is a very complicated behaviour because it is influenced by many interacting factors [1]. Mojet identified

six main factors that affect consumers food choices which interact each other such as intrinsic product characteristics and perception, biological and physiological factors, psychological factors, situational factors, socio-cultural factors, and extrinsic product characteristics—expectations [1]. In this paper, we will focus only on food products attributes, such as intrinsic and extrinsic product characteristics. Food products attributes can be split into two main groups, namely intrinsic and extrinsic attributes [2,3]. Intrinsic attributes are product attributes which cannot be changed or experimentally manipulated without also changing the physical characteristics of the food product itself [4] and are well known in the literature to play a crucial role in consumers' decision making [5–7]. Examples of intrinsic attributes are sensory attributes and nutritional components. Extrinsic attributes are not part of the physical product. Thus they can be changed without altering its characteristics [4]. Examples of extrinsic attributes are brand, price, organic logos and health claims. Extrinsic attributes are becoming increasingly important for consumers' choice [6,8–10]. Therefore, food quality is of important public interest, but it is also crucial for marketers, traders, and consumers [11]. Sellers use extrinsic attributes to convey information and send quality signals to consumers [3,12,13]. While in the absence of information, consumers evaluate food products according to their preferences (i.e. beliefs, attitudes, etc.) and sensory attributes, in disclosed information conditions their choices may also be influenced by the extrinsic attributes provided with food products [3,14,15]. This is because information is capable of steering consumers' evaluation since it can be used by consumers in their inference-making processes when choosing food products [3,16,17]. The influence of information on liking after tasting is described as the occurrence of a disconfirmation phenomenon regarding consumers' expectations towards food products [18]. Positive or negative disconfirmation may influence consumers' perception of sensory attributes. Hence it may affect food products' acceptance. However, in some cases, as shown in [19] information is not able to change consumers' acceptance and this may depend on different sensory preference patterns between consumers, consumers' different approach to the information [20] or information highlights features that are quite obvious for that kind of products and then expected by consumers [21]. The interaction between extrinsic and intrinsic attributes affects consumers' choices, as it is signalled by a large number of studies that investigated different food products [5,10,22–24].

Organic food is often perceived as a viable alternative for consumers worried about the presence of residues of dangerous agrochemicals in food and the negative consequences on the environment caused by intensive production methods. Organic food is well positioned in the mind of the Italian consumer as a more sustainable option and sometimes associated to health, local origin, and better taste [25–27]. The organic food market has grown slowly, but steadily in Italy during the last decade. Starting as niche products with a market share of around 1% of food expenditure in the early 2000s [28], it is now starting to be considered a promising segment by marketers. The latest market figures [29,30] show that the overall share is now over 3% and total domestic sales are about 3 billion EUR. The category is now steadily available and growing in supermarkets and its penetration is higher than 70%. Large retail is now the leading outlet, with a share of 65%. For some products, the organic market share of supermarket sales is substantial; for instance it is 37% for jams and 18% for eggs. Milk and dairy products are one of the main categories, with a value of over 30 million EUR.

Consumers' preferences for organic food are driven both by extrinsic and intrinsic attributes [28,31–34]. Among the intrinsic attributes, sensory features are among the most important criteria in organic food purchases [34–41]. As a result, organic food producers have started to provide information about the sensory properties of their products to better meet organic consumers' expectations and

wants. Among the extrinsic attributes, health and environmental protection are considered the key drivers of organic food consumption [28,33,37,42]. However, it might be the case that intrinsic and extrinsic attributes of organic foods interplay in affecting consumers' preferences. At this regard, the literature shows contrasting findings. While some studies indicate a positive effect of organic information on product liking [43], other studies show that information about organic production method does not affect consumer preferences. For example, in a study conducted with orange juice showed that if consumers give a low value of acceptance (i.e. based on sensory test) the effect of the extrinsic attribute (i.e. organic brand) is minimal [44]. Similar findings were found with cottage cheese [41] and wine [40]. Thus, as shown in [45] the effect of organic information can vary, and the degree of its influence depends on many factors, such as consumers' attitudes and trust in the information source [46], socio-demographic characteristics, and consumers' familiarity with organic food [17,46]. These studies clearly show a lack of research that investigates the interplay between intrinsic and extrinsic attributes for organic products. More studies are needed because it is very important for organic food practitioners to get more information about the effect of extrinsic attributes on consumers' liking (i.e. sensory perceptions) for improving the products during the product development process and better target marketing strategies in order to meet consumers' wants and needs [41] better.

The main aim of this paper is to test whether and how the provision of information affects organic consumers' preferences and sensory perception of two food quality products (i.e. strawberry yoghurt and cookies). To reach this aim, we collected consumer preferences data (i.e. the degree of liking) and the perception of several sensory attributes of the above-mentioned products. In addition, we investigated consumers' habits and attitudes regarding drivers of organic consumers, their attitudes towards product and label information as well as organic consumption frequency to check if these data affect the degree of liking and sensory perception of the tested products.

In terms of contribution to the literature, this study is one of the few attempts to better understand the interplay between intrinsic and extrinsic attributes for organic products, in particular the role of information on organic consumers' preferences and sensory perception of organic food products. We aimed to contribute to the literature regarding organic consumer behaviour which, despite the increasing of its market, has got little attention about the importance of sensory preferences and perceptions and the role of label information.

We use data from a survey performed in Italy during 2011 with organic consumers collected in the framework of the ECROPOLIS\* project.

## **2. Materials and methods**

### *2.1. Questionnaire design and scales*

To test the effect of information on organic consumers' liking and sensory perceptions, we used the well-established method based on the comparison of blind and informed tests of products. It

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\* ECROPOLIS project "Organic Sensory Information System (OSIS): Documentation of sensory properties through testing and consumer research for the organic industry". Project co-funded by the European Commission under the 7th Framework Programme for European Research & Technological Development. Countries involved: Switzerland, Germany, Italy, France, The Netherlands and Poland.

provides detailed, accurate and direct measures about sensory and extrinsic (informed) attributes and makes it possible to investigate their interactions and to investigate confirmation and disconfirmation mechanisms in informed product tests [47].

The survey was conducted by using a standardised questionnaire split into two sections.

In the first section, interviewees were asked to evaluate several statements concerning their organic food purchase motivations (e.g. because of better taste, healthier, etc.) and attitudes towards information on food products. We put special emphasis on sensory labelling to evaluate the use and the usefulness of quality labels with special references to sensory labels (e.g. importance of labels to evaluate food products, etc.) (see Appendix A). Motivations for organic food purchase and attitude towards information were evaluated by using a 7-point Likert scale ranging from 1—*I totally disagree* to 7—*I totally agree*.



The second section of the survey consisted of hedonic taste tests using a within-subject design. Consumers were asked to evaluate two couples of food products (2 samples of strawberry yoghurts and 2 samples of shortbread cookies) according to overall liking and degree of perception of some sensory attributes, in blind and informed tasting sessions. Strawberry yoghurt and cookies were chosen due both to their availability and the high frequency of consumption in Italy. Moreover, unlike fresh fruit and vegetables, they had a homogeneous taste and allowed a simple preparation of the samples, ensuring a standardised testing procedure. Focus group interviews with consumers of organic products and researchers' expertise allowed to assume that organic food products are generally characterized by specific expectations, in terms of taste, appearance, nutritional content, ingredients and processing, such as more natural and intense flavour, visible minor flaws, less sugar, absence of added flavours [48,49]. Therefore, in each couple of food samples, one sensory feature was selected as the organic indicator, and samples were prepared to simulate the organic and the conventional version of the same product. The sensory features chosen as organic indicators were fruitiness for strawberry yoghurt and sweetness for cookies because both could be interpreted as an indicator of naturalness and authenticity. The other sensory attributes evaluated, namely sweetness and firmness for the yoghurt, and crunchiness and artificial flavour for cookies were used as distracting attributes. A basic organic strawberry concentrate was added to plain organic yoghurt to simulate the organic version of the product, with the aim to test the perception of fruitiness in yoghurt. The conventional version was created by adding a strawberry flavouring to the basic organic fruit preparation. Regarding the perception of sweetness in cookies, a different content of sugar was used for cookies' preparation, to simulate the organic version (3 times less sugar) and the conventional version of the same product. The idea of choosing only one attribute to differentiate the two versions of each product (different strawberry extracts to test fruitiness' perception in yoghurts and different sugar contents to test sweetness' perception in cookies) depended on the need to trace back sensory evaluations unambiguously to the variables that were manipulated [50]. Then, two different food products were included in the tasting sessions, to allow the sensory evaluation of a higher number of "organic specific" sensory attributes.

To avoid package effects on subjects' evaluation, the two couples of products (i.e. "organic" and "conventional" strawberry yoghurts as well as "organic" and "conventional" cookies) were tested first blindly, and the samples were presented to the interviewees without packaging. Consumers expressed their overall liking and their perception of specific sensory attributes (sweetness, firmness and fruitiness for the yoghurt; sweetness, crunchiness and artificial flavour for the cookies), using a 7-point hedonic scale ranging from 1—*Not at all* to 7—*Very much* (Figure 1).

Please taste the given products and express your liking. How much do you like this product?								
Not at all			Very much					
<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>		
To what extent do you perceive the following aspects?								
Products	Aspects	Not at all						Very much
Strawberry yoghurt	Sweetness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Firmness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Fruitiness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cookies	Sweetness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Crunchiness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Artificial aroma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Figure 1.** Example of forms used in the sensory tests.

In the informed test session, the same products were again offered to consumers, but provided with labels containing information about ingredients and processing methods, and the organic logo, in case of “organic” samples (Figure 2).

Organic products	Conventional products
<p><b>Sample 490</b></p>  <p>Strawberry yoghurt 3.7% fat content Soured mildly Without added flavours</p>	<p><b>Sample 314</b></p> <p>(without indication that the product is organic or conventional)</p> <p>Strawberry yoghurt 3.7% fat content Soured mildly With added flavours</p>
<p><b>Sample 217</b></p>  <p>Short pastry cookie Reduced sugar content</p>	<p><b>Sample 835</b></p> <p>(without indication that the product is organic or conventional)</p> <p>Short pastry cookie Enhanced sugar content</p>

**Figure 2.** Labels provided during the branded test.

The samples were evaluated according to the same attributes.

Finally, socio-demographic characteristics were collected. The first version of the questionnaire was pre-tested with 30 consumers and then reviewed in the final version.

## 2.2. Recruitment and locations

Consumers were recruited both with the support of an external research institute and by internal recruitment (University of Bologna, Italy). According to the research design, we included only organic consumers in the survey using quota sampling. Criteria to select participants were the following:

- Gender: 2/3 of the sample should be females and 1/3 males;
- Age: 50% of the sample should be in the range between 18–45 years and 50% between 46–75 years;
- Light and Heavy Users (LUs and HUs): 70% of the sample should be LUs and 30% should be HUs of organic food. To distinguish between LUs and HUs, the index applied in the Second German National Nutritional Survey [50,51] was used. This index is based on the frequency of consumption of eight different food categories, in their organic version. Consumers whose index scored less than 1 were excluded; consumers with scores lower than 2.75 were considered LUs while consumers with scores from 2.75 up were considered HUs. The hypothesis supporting the decision to recruit specific quotas of LUs and HUs is that organic consumers' behaviour and appreciation for organic food properties could differ according to their search for and acceptance of specific organic food features. Concerning sensory properties, it is presumed that regular and occasional consumers of organic food have a different familiarity to organic sensory attributes. Therefore, a kind of different sensory background and knowledge could be expected to affect their preferences and evaluations;
- Consumers should not be employed in marketing research institutes, press agencies, television, radio and food industry.

Finally, 301 Italian organic consumers were recruited. The consumer tests were carried out face-to-face between November 2010 and January 2011, in two different consumer labs in Bologna (Italy). Tests were conducted by using an electronic questionnaire (developed using the EyeQuestion software) or paper questionnaires, as consumers preferred. Tests lasted between 30 and 45 minutes and at the end of the test a 15 Euros participation reward was given to each participants.

### 2.3. Data analysis

Data were analysed using the SPSS Statistical Software 17.0. Descriptive analysis was used to describe the organic consumers' characteristics in terms level of organic food consumption (LUs and HUs), socio-demographics, distribution channels where they purchase organic food, and motivations to purchase organic food. Given the characteristics of our data as ordinal data, non-parametric tests were considered more suitable [52]. Mann-Whitney U tests [53] were employed to compare between LUs and HUs characteristics and attitudes towards core organic attributes and product information. Wilcoxon signed-rank tests [54] were carried out on paired samples on blind and informed tests to investigate whether the affective attitude towards organic and nutritional information affected the perception of sensory attributes.

## 3. Results

### 3.1. Sample description: Socio-demographics

Table 1 shows the socio-demographic characteristics of the consumers investigated. The final sample was composed by LUs (70.7%) and HUs (29.3%) while regarding gender 65.4% of the sample were females and 34.6% were males. The majority of consumers were in the middle age (from 36 to 55 years old) and counted for about 48% of the sample, followed by younger consumers (from 18 to 35 years old), 31.2%, and mature consumers (from 56 to 75 years old), 21.0%, respectively. Considering the degree of education, the majority of respondents declared to hold a high school



diploma (57.1%) while about 29% of the consumers interviewed affirmed to hold a higher degree of education, such as bachelor or master or PhD. Interviewees without qualification represent only the 0.3% of the sample. Regarding income, about 44% of the consumers have a monthly income lower than 2000 € while 36.5% have a monthly income between 2000 € and 3000 €, and higher monthly incomes (from 3000 € and more) account for the remaining 20% of the interviewed consumers. Mann-Whitney U tests indicate that socio-demographics between LUs and HUs did not differ significantly.

**Table 1.** Socio-demographics of light and heavy users in Italy.

Socio-Demographics	LUs	HUs	Total
Number of participants	181 (100%)	120 (100%)	301 (100%)
Gender			
Female	112 (61.88%)	85 (70.83%)	197 (65.45%)
Male	69 (38.12%)	35 (29.17%)	104 (34.55%)
Age group			
18–35 yr.	62 (34.25%)	32 (26.67%)	94 (31.23%)
36–55 yr.	76 (41.99%)	68 (56.67%)	144 (47.84%)
56–75 yr.	43 (23.76%)	20 (16.67%)	63 (20.93%)
Degree of education			
Without qualification	1 (0.56%)	0 (0%)	1 (0.34%)
Below high school diploma	25 (14.12%)	15 (12.50%)	40 (13.47%)
High school diploma	99 (55.93%)	69 (57.50%)	168 (56.57%)
Undergrad- and Graduation school	51 (28.81%)	35 (29.17%)	86 (28.96%)
Other	1 (0.56%)	1 (0.83%)	2 (0.67%)
Income level			
Lower than 2000 €	83 (45.86%)	49 (40.83%)	132 (43.85%)
between 2000–3000 €	65 (35.91%)	45 (37.50%)	110 (36.54%)
More than 3000 €	33 (18.23%)	26 (21.67%)	59 (19.60%)

### 3.2. Organic consumers' purchase motivations and willingness to pay (WTP)

On average, health and environmental concern are the most important drivers for organic consumers, followed by animal welfare, suitability to lifestyle, and taste (Table 2). A Mann-Whitney test shows that the difference between LUs and HUs in rating organic food purchase motivations is significant in most of the cases, except for animal welfare and childhood memories. Rating evaluations follow the same trends in the two groups (highest rating for health motivations, followed by environmental concerns, animal welfare, suitability and taste; lowest rating for childhood reminiscence). Nevertheless, HUs rated all the organic food purchase motivations higher than LUs.

**Table 2.** Comparison of different motivations to purchase organic food between light and heavy users by Mann-Whitney U test.

Motivations	LUs		HUs		Total		Asymp. Sig (2-tailed)
	Mean	SD	Mean	SD	Mean	SD	
Health	1.89	1.386	2.33	1.040	2.07	1.276	0.002**
Environment	1.82	1.436	2.14	1.162	1.95	1.341	0.058
Animal welfare	1.30	1.623	1.76	1.250	1.49	1.500	0.038*
Suitable to me	0.92	1.651	1.70	1.326	1.23	1.575	0.000**
Taste	0.74	1.586	1.18	1.333	0.91	1.503	0.032*
Remind of childhood	-1.09	1.998	-0.80	1.877	-0.97	1.953	0.090

Note: The respondents were asked to give a score between 1 to 7 (*I totally disagree to I totally agree*) for the statement of motivations to purchase organic food. Mann-Whitney U test were employed to test the difference between light and heavy consumers.

\* The mean difference is significant at the 0.05 level.

\*\* The mean difference is significant at the 0.01 level.

In addition, considering the stated willingness to pay (WTP) a higher price for organic products, the difference between the two groups is significant ( $z = -2.753$ ,  $p = 0.006$ ): HUs stated a higher WTP for organic food (mean = 0.39, SD = 1.691), whereas LUs showed a lower WTP (mean = -0.20, SD = 1.648).

### 3.3. Consumers' attitudes towards label information

To evaluate consumer attitudes towards information provided on food labels, we asked consumers to express their agreement to several statements related to the use and the usefulness of quality labels with special references to sensory labels (Table 3). On average, consumers showed a positive attitude towards the use of information reported in the labels. Consumers rejected the idea that the amount of information on food products do not help in buying decision. Also, consumers declared to read carefully labels on food products and to be willing to receive more information about sensory properties of food they are going to buy. Regarding quality labels, consumers strongly agreed about the usefulness of labels to evaluate food quality, and they also confirmed that in purchase situations they search for labels to buy high-quality products.

In addition, when consumers were asked to express their opinion about sensory labelling, they showed a positive attitude. Sensory labelling is seen as a useful hint to find the kind of taste consumers are looking for. Even though sensory perception is generally a matter of experience, they reject the idea that sensory labels on food products are completely ineffective and useless. Comparing LUs and Hus, we found that these two groups of consumers only differ in terms of careful reading of information on packaging. Indeed, HUs read more carefully what is written on the packaging of food products compared to LUs.

**Table 3.** Evaluation of attitude towards information and labels.

Attitude towards information and labels	Full sample (N = 301)		Light Users (N = 213)		Heavy Users (N = 88)		Comparison: LU and HU
	Mean	SD	Mean	SD	Mean	SD	<i>p</i> -value
1. I read very carefully what is written on the packaging of food products	1.61	1.47	1.48	1.53	1.92	1.27	0.027*
2. The amount of information on food products doesn't help me making a buying decision	-0.84	1.93	-0.76	1.94	-1.06	1.89	0.181
3. I would like to get more information about sensory properties of food products	1.14	1.72	1.17	1.69	1.07	1.80	0.723
4. Labels are useful to evaluate the quality of food products	1.64	1.38	1.61	1.39	1.74	1.38	0.382
5. I am searching for labels in order to buy high quality products	0.92	1.64	0.80	1.67	1.20	1.55	0.050
6. Labels referring to the sensory properties of food could help me to find the kind of taste I am looking for	1.57	1.40	1.55	1.40	1.63	1.38	0.702
7. Sensory perception should be a matter of experience; a label is not useful at all	-0.94	1.80	-0.96	1.78	-0.89	1.87	0.845

Scale: 7-point Likert scale ranging from 1 = *I totally disagree* to 7 = *I totally agree*. Test of significance used is Mann-Whitney U test. \*  $p \leq 0.05$ ; \*\*  $p \leq 0.01$ .

#### 3.4. Blind and informed tasting sessions: Consumers' evaluation of organic and conventional products and the effect of information on sensory perceptions

In the two tasting sessions, two couples of food products in their organic and conventional versions were evaluated by consumers. As previously mentioned, in each round consumers had to provide ratings for the perception of some sensory attributes and the overall liking of the products.

##### 3.4.1. Full sample

Data analysis reveals that the provision of information affects product evaluations and sensory perceptions (Table 4). For yoghurts, both fruitiness and firmness obtained significantly lower scores in the informed sessions compared to the blind ones, both for organic and conventional yoghurt, while the evaluation of sweetness does not show any significant differences between organic and conventional yoghurts and blind/informed tests. Regarding overall liking, for organic strawberry yoghurt samples the information provided did not affect the evaluations significantly, whereas conventional yoghurt samples obtained significantly lower scores. Concerning strawberry yoghurts, negative effects of label and product information on consumers' perceptions of some sensory attributes were found, and some justifications can be hypothesized. The information "without additional flavours" provided with the organic yoghurt samples could have induced consumers to

evaluate with higher scores their taste perceptions for fruitiness and to assign a rating more carefully. Concerning conventional yoghurt samples, it seems that consumers connect fruitiness with something natural, and information about the presence of additional flavours seems to penalise the perception of “natural” strawberry aroma and then of fruitiness.

**Table 4.** Comparison of overall liking and sensory perceptions for yoghurt and cookies between blind and informed test (full sample).

Sensory attributes	Full sample	Organic yoghurt (blind vs. informed)		<i>p</i> -value	Conventional yoghurt (blind vs. informed)		<i>p</i> -value
	(N.)	Mean	SD		Mean	SD	
Fruitiness	301	0.80/0.53	1.53/1.57	0.002**	0.77/0.26	1.54/1.53	0.000**
Firmness	301	0.74/0.55	1.36/1.42	0.019*	0.55/0.28	1.31/1.40	0.001**
Sweetness	301	-0.56/-0.67	1.50/1.53	0.148	-0.05/-0.13	1.62/1.57	0.283
Overall liking	301	0.74/0.59	1.41/1.52	0.145	0.80/0.33	1.41/1.50	0.000**
Sensory attributes	Full sample	Organic cookies (blind vs. informed)		<i>p</i> -value	Conventional cookies (blind vs. informed)		<i>p</i> -value
	(N.)	Mean	SD		Mean	SD	
Sweetness	301	-0.41/-0.48	1.55/1.58	0.477	0.64/0.79	1.60/1.55	0.059
Crunchiness	301	-0.81/-0.67	1.58/1.55	0.107	1.60/1.57	1.25/1.07	0.559
Artificial aroma	301	-1.09/-1.17	1.65/1.59	0.294	-0.76/-0.41	1.70/1.65	0.000**
Overall liking	301	0.16/0.37	1.68/1.68	0.010**	0.58/0.47	1.62/1.61	0.097

Scale: 7-point hedonic scale ranging from 1 = *Not at all* to 7 = *Very much*. Test of significance used is Wilcoxon test. \*  $p \leq 0.05$ ; \*\*  $p \leq 0.01$ .

For cookies, the sweetness was used as an indicator to differentiate between organic and conventional cookies. Despite the use of labels with specific information regarding the processing method (organic vs. conventional), and the level of some ingredients (“reduced sugar content” for organic cookies vs. “enhanced sugar content” for conventional ones), no significant differences emerged between blind and informed tests. Similarly, the ratings that consumers assigned to the perception of the sensory attribute crunchiness did not differ significantly between blind and informed tests, both for organic and conventional cookies. Label information (presence/absence of organic logo) seems to affect the perception of the sensory attribute artificial aroma, as consumers declared a significantly different (higher) perception of artificial aroma in conventional cookies, but not in organic cookies. In this case, we suppose that the awareness to be evaluating a conventional product (in opposition to an organic one) could have induced consumers to perceive a stronger artificial flavour. Regarding overall liking, a positive and statistically significant effect of information was found in the evaluation of organic cookies, that consumers appreciated more, once they became aware of product characteristics.

Data analysis on the whole sample allows to identify a trend in consumers’ responses: The provision of information leads, in general, to lower scores for sensory attributes’ perceptions, and some hypotheses can be advanced. First, information attached to the samples could have induced consumers to think more carefully about their perceptions and re-adjust their judgments in the informed round. Second, providing information could have aroused expectations about the products

in the informed session that, on the contrary, were disappointing after tasting the products for some respondents. To understand whether organic consumers differ in their sensory perceptions and their sensitivity to information and labels according to their frequency of consumption of organic food, data analysis of blind and informed tests was carried on also on the two separate groups of LUs and HUs of organic products.

### 3.4.2. Light users

In this section, the results of blind and informed tests on LUs are presented (Table 5). For yoghurts, fruitiness obtained significantly lower scores for both the strawberry yoghurts in the informed tasting session. In both cases LUs assigned lower ratings when labels were provided, suggesting again that product-specific information (without/with added flavours) may have affected consumers' expectations in terms of "natural" fruity aroma of both yoghurt samples and determined the lowering of the scores concerning the perception of a sensory attribute closely related to the information provided. Firmness show that while LUs scores did not differ significantly between blind and informed tests about organic strawberry yoghurt, this difference was found to be statistically significant for the conventional strawberry yoghurt sample, whose firmness scored a lower rating in the informed test, highlighting the negative influence of information. As for overall liking of the yoghurt, data analysis revealed that product information and the specification "organic/conventional" are not able, in general, to affect LUs opinion significantly, with the exception of conventional yoghurts, where a significant difference between blind and informed test in terms of overall liking was found. In this case, both the information about the processing method (conventional) and the ingredients (additional flavours) may have negatively affected by light consumers' opinion about the general liking of the product.

**Table 5.** Comparison of overall liking and sensory perceptions for yoghurt and cookies between blind and informed test for LUs.

Sensory attributes	Light users	Organic yoghurt (blind vs. informed)		<i>p</i> -value	Conventional yoghurt (blind vs. informed)		<i>p</i> -value
	(N.)	Mean	SD		Mean	SD	
Fruitiness	213	0.84/0.50	1.54/1.58	0.002**	0.77/0.22	1.55/1.58	0.000**
Firmness	213	0.73/0.56	1.39/1.40	0.066	0.51/0.31	1.33/1.42	0.047*
Sweetness	213	-0.54/-0.63	1.54/1.54	0.387	-0.10/-0.12	1.61/1.57	0.709
Overall liking	213	0.69/0.61	1.41/1.52	0.590	0.72/0.29	1.42/1.50	0.000**
Sensory attributes	Light users	Organic cookies (blind vs. informed)		<i>p</i> -value	Conventional cookies (blind vs. informed)		<i>p</i> -value
	(N.)	Mean	SD		Mean	SD	
Sweetness	213	-0.48/-0.53	1.55/1.53	0.733	0.66/0.83	1.60/1.54	0.101
Crunchiness	213	-0.88/-0.77	1.58/1.46	0.244	1.55/1.62	1.29/1.02	0.458
Artificial aroma	213	-1.16/-1.20	1.57/1.55	0.574	-0.69/-0.38	1.71/1.65	0.002**
Overall liking	213	0.13/0.24	1.67/1.65	0.237	0.54/0.45	1.65/1.61	0.225

Scale: 7-point hedonic scale ranging from 1 = *Not at all* to 7 = *Very much*. Test of significance used is Wilcoxon test. \*  $p < 0.05$ ; \*\*  $p < 0.01$ .

For cookies, similarly to the full sample, despite the use of labels with specific information regarding the processing method (organic vs. conventional) and the level of some ingredients (“reduced sugar content” vs. “enhanced sugar content”), no significant differences emerged between blind and informed tests in terms of sweetness for both cookies samples (organic and conventional). LUs perception did not change significantly between blind and informed tests neither with reference crunchiness and overall liking of the cookies, whereas a significant difference was found in their perception of the sensory attribute artificial aroma when they evaluated conventional cookies. LUs declared a higher perception of the artificial aroma in the informed tasting session; in this case, it seems that LUs paid higher attention to the information concerning the processing method (“conventional”) provided with the “not organic” cookie, which significantly affected their evaluation.

#### 3.4.3. Heavy users

Some interesting findings also emerged from data analysis on organic HUs (Table 6). For organic strawberry yoghurt, we have not found any significant differences between blind and informed test concerning the overall liking and the sensory attributes investigated. On the other hand, concerning the conventional strawberry yoghurts, consumers found the fruitiness, firmness and overall liking lower scores when information about the production method was provided. This means that information about both processing method (organic/not organic) and ingredients (without/with added flavours) affected HUs perception negatively, influencing their opinions about conventional yoghurt samples significantly. The idea of a non-organic product and the information about the additional flavours could have affected HUs, and their sensory perception could have been steered towards a more critical and negative evaluation of sensory attributes closely related to the information provided with the conventional yoghurt (not “natural”, and then not fruity). However, the evaluation of sweetness did not change significantly between blind and informed tasting sessions. About overall liking, ratings decreased significantly in the informed tests for the conventional yoghurt.

HUs also evaluated crunchiness and artificial aroma of cookies. While no significant differences were found when comparing blind and informed tests for the organic samples, significant differences were found between blind and informed tests when HUs evaluated the conventional samples. The perception of conventional cookies’ crunchiness decreased significantly after the provision of information; similarly, the perception of artificial aroma in conventional cookies increased in the informed test, highlighting again a specific effect of information on consumers’ sensory reactions. In this case, it seems that the information on processing methods (organic versus conventional) can persuade HUs to better focus on a specific sensory attribute (particularly “artificial aroma”) that can be considered closely related to the processing method. Moreover, concerning conventional cookies, information can affect HUs opinion negatively, leading to a higher perception of the artificial aroma. The latter point seems to highlight the appeal of the organic logo on regular users, in contrast with a sort of bias towards product features that generally belong to conventional food processing methods.

**Table 6.** Comparison of overall liking and sensory perceptions for yoghurt and cookies between blind and informed test for HUs.

Sensory attributes	Heavy users	Organic yoghurt (blind vs. informed)		<i>p</i> -value	Conventional yoghurt (blind vs. informed)		<i>p</i> -value
	(N.)	Mean	SD		Mean	SD	
Fruitiness	88	0.69/0.63	1.50/1.53	0.447	0.77/0.36	1.51/1.41	0.032*
Firmness	88	0.77/0.52	1.31/1.46	0.128	0.65/0.22	1.28/1.36	0.003**
Sweetness	88	-0.60/-0.77	1.40/1.51	0.167	0.09/-0.14	1.66/1.56	0.173
Overall liking	88	0.85/0.56	1.40/1.52	0.062	1.00/0.42	1.37/1.49	0.001**
Sensory attributes	Heavy users	Organic cookies (blind vs. informed)		<i>p</i> -value	Conventional cookies (blind vs. informed)		<i>p</i> -value
	(N.)	Mean	SD		Mean	SD	
Sweetness	88	-0.25/-0.36	1.54/1.70	0.403	0.58/0.70	1.58/1.59	0.346
Crunchiness	88	-0.65/-0.44	1.58/1.73	0.301	1.72/1.48	1.15/1.17	0.021*
Artificial aroma	88	-0.91/-1.10	1.84/1.70	0.301	-0.93/-0.49	1.67/1.65	0.010**
Overall liking	88	0.24/0.69	1.70/1.73	0.001**	0.66/0.51	1.56/1.61	0.250

Scale: 7-point hedonic scale ranging from 1 = *Not at all* to 7 = *Very much*. Test of significance used is Wilcoxon test. \*  $p \leq 0.05$ ; \*\*  $p \leq 0.01$ .

#### 4. Conclusions

The study aimed to investigate whether and how the provision of information affects organic consumers' preferences and sensory perception of two food quality products (i.e. strawberry yoghurts and cookies). Results show that information affects consumers' preferences and sensory perceptions, but the effect depends on the product category, sensory attributes tested and the types of information provided. The frequency of organic food consumption (i.e. LUs and HUs) does not affect consumers' preferences and sensory perceptions.

While the presence of the "organic logo" does not have so much effect on consumers' evaluation, its absence influenced consumers' judgement significantly, as the matter of fact that all of them are organic consumers; therefore, they tend to look for the organic certification and logo at first. This had a negative reflection on consumers' perception and evaluation of those sensory attributes that can be somehow connected with conventional food processing methods. Our results are in contrast to the study of Poelman et al. [45] that investigated the influence of information about organic production on preferences for and perception of pineapple in the UK and the Netherlands. They found that the respondents with a positive attitude towards organic products perceived products to have a stronger sensory impact in the presence of information than in its absence. However, they also did not find a clear pattern of the responses as well. Nevertheless, it is widely accepted that organic information is assumed to have, if any, a positive effect on consumers' evaluation [43]. In the current study, some cases of lower rates for organic-labelled products could lie in the fact that information aroused consumers' expectations, which maybe were disappointed by the tasting experience. Moreover, the well-established Italian culinary tradition and the related sensory

education could have affected consumers' expectations and hindered the sensory performance of organic-labelled products [55].

Information is more effective on consumers' behaviour when it is closely connected with a sensory attribute under investigation. Results revealed that even though the differences in ratings between blind and informed tests are not always significant, the trends of some evaluations have been influenced by the information provided. Synergy seems to take place between the presence/absence of organic logo and some specific information provided, leading to an effect on the perception of sensory attributes. Concerning conventional products, the idea of a non-organic product and some specific information about the ingredients significantly affected consumers' judgements, and their sensory perception could have been steered towards a more critical evaluation of some attributes. However, these effects are product and attribute specific, as we did not find the clear trend or specific patterns of the consumers' sensory perception. Several studies found that the effect of information may depend on product categories and type of information provided [56–58]. This means that sensory information may have no/positive/negative effects on certain products, for instance, reduced-fat content has a negative effect on cheeses, but it has a positive effect on ice-cream and no effect on yoghurt. Moreover, as outlined by Schuldt and Hannahan [59], responses toward information carried by labels with strong connotations, such as organic, are not always influenced by a positive halo effect, and negative taste inferences can derive if consumers' personal beliefs are not congruent with the values represented by that specific label.

The main implication of this work for the Italian market operators is twofold. On one hand, it is not safe to assume that the organic attribute would always be interpreted by consumers as a signal of a better taste since this appears to depend on the product. On the other hand, especially for consumers who may have raised expectations due to the organic label, a disappointing experience may be dangerous in terms of satisfaction and brand reputation. This is extremely important in the Italian market where the role of large retail chains in the organic sector has strongly increased.

A careful and systematic analysis of a product's sensory performance could be helpful, by using trained experts and involving consumers in sensory tests, to understand product peculiarities and its positioning towards competitors. The results of this study show that it is very important to conduct consumer tests, which combine sensory and extrinsic attributes, before putting new products on the market. Consumer tests are useful to develop products that better meet consumers wishes and better target the market, and may, in turn, reduce the risk of product failure [60], even though they cannot completely eliminate this risk.

As it is well known, pre-purchase quality expectations affect consumers' purchasing decision and the confirmation/disconfirmation between expectations and experiences will determine consumers' satisfaction [3]. Hence, information on product packages should be carefully provided so as not to mislead consumers' expectation. Therefore, the industry should be more careful when providing information because it is likely to affect consumers' expectation and might lead to disappointment if the experience does not meet their expectation. In addition, our opinion is that consumer tests should integrate a careful analysis of the perception of value, using reliable methods to estimate the willingness to pay of consumers for the product or specific attributes.

Despite the interesting findings, some limitations of the study must be highlighted. The first limitation lies in sample size and representativeness. The sample looks biased, therefore it does not allow drawing conclusions generally valid for the population of Italian consumers. Regarding the organic consumer classification into HU and LU, the cut off between LUs and HUs was set



according to the German statistics on organic food consumption frequency, therefore the composition of light and heavy users groups in the Italian survey could not be correct. It would have probably been better to use scanner data to identify light and heavy consumers of organic products more objectively.

Some limitations can also be found in sensory tests' design: food samples were presented in the same order during the tasting sessions, therefore sequence or carryover effects could have taken place. Moreover, tests were designed in a simple way with the aim to analyse the effect of information, but they did not allow describing separately the influence of generic information, product specific attributes and organic/conventional processing method on consumers' perceptions, if existing.

Further research is thus recommended, for instance with similar studies using different products combined with different sensory and extrinsic attributes, in order to verify whether some patterns of the role of information on sensory perceptions and consumer liking could be identified.

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### **Conflict of interest**

All authors declare no conflicts of interest in this paper.

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