

Consumer preference for chicken breast may be more affected by information on organic production than by product sensory properties

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ABSTRACT Conventional chicken from a fast-growing strain (CC), organic chicken from a slow-growing strain (OSG), and organic chicken from a fast-growing strain (OFG) were used to assess descriptive sensory differences between organic and conventional breasts, to verify whether differences were perceived by consumers and to evaluate the effect of information about organic production on liking. A conventional quantitative–descriptive analysis was performed by a trained panel of 10 members on breast slices (1 cm thick) grilled at 300°C. A 150-member consumer panel (from southern, central, and northern Italy) rated CC, OSG, and OFG breasts according to 3 types of evaluation: tasting without information (perceived liking), information without tasting (expected liking), and tasting with information (actual liking). Breasts from different sources were clearly discriminated by the trained panel as meat from CC was perceived more tender than OFG ($P < 0.05$) and OSG ($P < 0.001$), more fibrous than OFG ($P <$

0.05) and OSG ($P < 0.001$), and leaving more residue than OFG ($P < 0.05$) and OSG ($P < 0.001$), whereas OSG was assessed as less juicy before swallowing than OFG and CC ($P < 0.05$) and less fibrous than OFG ($P < 0.05$). No significant differences were observed by consumers for perceived liking. However, consumer expected liking scores were higher for organic than for conventional products ($P < 0.001$) and actual liking of organic breasts moved toward the expectancy. In particular, actual liking scores were higher than perceived liking in blind conditions ($P < 0.001$ and $P < 0.01$ for OFG and OSG, respectively). We conclude that trained panelists were able to discriminate chicken breasts from different sources, whereas untrained consumers were not. However, consumer liking was markedly affected by the information given on the organic production system, thus providing a tool to differentiate the product in an increasingly competitive market.

Key words: chicken breast, organic production, information, liking, sensory

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INTRODUCTION

Consumers' food choices are influenced by several aspects of the products. In particular, for meat and meat products, 4 main qualitative features were identified by Brunsø et al. (2002): hedonic, health, convenience, and process characteristics. Only few aspects can be perceived before purchasing (e.g., those related to aspect, such as color, marbling, and texture), whereas most of them can be perceived after purchasing, at the moment of consumption (e.g., sensory properties). However, some others (e.g., credence qualities) have to be

communicated to be perceived. These aspects, mainly related to process characteristics [such as organic, animal welfare friendly, genetically modified organism (GMO)-free, environmental friendly systems] are of increasing importance in driving food product choice (Grunert, 2005).

As to organic production, the demand for food produced according to organic rules has been growing in the United States and Europe (Padel et al., 2008), as this method fulfills most of the major concerns of consumers. However, few studies assessing consumer preference for poultry production methods have been conducted (Larue et al., 2004; Husak et al., 2008). Pouta et al. (2010) found that, although the effect of production method had a minor effect on consumer choice behavior compared with the country of origin, organic production labeling positively affected the preference for

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broiler fillet. According to a study assessing consumer willingness to pay for organic chicken, USDA organic certification was valued more than the general organic label, implying that consumers trust the USDA organic products more than a general organic label (Van Loo et al., 2011). Studies about organic production of beer (Caporale and Monteleone, 2004), bread (Kihlberg et al., 2005), pineapple (Poelman et al., 2008), beef (Napolitano et al., 2010b), and cheese liking (Napolitano et al., 2010a) have shown that expectations induced by the information can affect the quality perception. In particular, when expectations are disconfirmed (either positively: liking without external information is higher than expected, or negatively: liking without external information is lower than expected), an assimilation occurs and the liking moves toward the expectations (Cardello and Sawyer, 1992).

Although numerous studies have reported the influence of credence characteristics on choice behavior and animal product acceptability (see Napolitano et al., 2010c for a review), sensory properties are also important in affecting meat liking and sensory analysis performed by trained panelists remains the most appropriate tool to explain differences between treatments as perceived by humans.

The effect of organic production on meat quality, including chicken, has been recently reviewed (Braghieri and Napolitano, 2009); however, little is known on sensory properties and acceptability of organic chicken and on the effect of the information about organic production on chicken liking.

Thus, the present study was aimed to assess sensory differences between organic and conventional chicken breasts (organic fast-growing, organic slow-growing, and conventional fast-growing chickens) using a trained panel to verify whether consumers were also able to perceive differences among the same products and to evaluate the effect of information about organic production on chicken liking. The findings may help identifying the most appropriate strategies to be used by the chicken industry to fulfill consumer sensory and ethical needs in the developing market of the organic chicken.

MATERIALS AND METHODS

Products

Three products were used: conventional chicken (CC) from a fast-growing strain (Cobb-700), organic chicken (OSG) from a slow-growing strain (Lohmann-

Brown), organic chicken (OFG) from a fast-growing strain (Cobb-700). Animals were kept indoors from birth to 21 d of age at 20 subjects/m². Subsequently, chickens from groups OSG and OFG only received an additional 10 m²/head of space allowance. The CC birds were slaughtered at 42 d of age, OFG at 81 d of age (minimum age at slaughter allowed by Regulation EC 889/2008 on organic farming), and OSG birds at 96 d (this age was chosen to achieve a market live weight typical for this type of bird in Italy). Breast slices (80 g, 1 cm thick) were grilled at 300°C to an internal temperature of 72°C assessed using a thermocouple probe inserted into the meat. Mean cooking time was 7 min. Samples (80 and 20 g for consumers and trained panelists, respectively) were offered to the subjects immediately after cooking (serving temperature of 50°C; Olson et al., 1980). Sensory evaluations were performed in a controlled sensory analysis laboratory (ISO, 1988) equipped with individual booths and under red lighting.

Quantitative Descriptive Sensory Analysis

The 3 products were assessed by a trained panel of 10 members (4 males, 6 females, aged between 25 and 40 yr), using the conventional descriptive analysis rules (ISO, 1994). During preliminary sessions, panelists, on the basis of available literature (Castellini et al., 2002b,c), developed and then agreed on a consensus list of 5 texture-based attributes and their definitions. The sensory traits and their definitions are summarized in Table 1. After a further training on the use of the scale (assessors rated the samples on 100 mm unstructured lines with anchor points at each end, 0: absent and 100: very strong intensity), a total of 3 sessions were carried out. For each daily session, 3 samples were presented. Each sample was evaluated in triplicate. Samples were coded with 3-digit randomized numbers and served in random order according to sample, replicate, and assessor.

Consumer Analysis

Subjects were recruited in 3 different locations: Potenza (main city in the region Basilicata, southern Italy), Ancona (main city in the region Marche, central Italy), and Udine (main city in the region Friuli Venezia Giulia, northern Italy). The consumer panel consisted of 150 subjects (49 from southern Italy, 51 from central Italy, and 50 from northern Italy location). They were

Table 1. List of sensory attributes used by 10-member trained panel

Item	Definition
Tenderness	Effort required to compress the sample between molars (very tough to very tender)
Initial juiciness	Amount of juice released in the mouth during the first 3 bites of mastication (small to high amount)
Final juiciness	Amount of juice present in the mouth before swallowing (small to high amount)
Fibrousness	Extent to which fibers strands are perceived on chewing (not to very fibrous)
Residue	Amount of residue remaining in the mouth after swallowing (small to high amount)

Table 2. Socio-demographic features of the subjects participating in the consumer test

Item	Level	Number	Percentage
Age (yr)	20 to 39	42	28
	40 to 59	51	34
	>59	57	38
Sex	Female	66	44
	Male	84	56
Education level	Primary school	8	5
	Secondary school	18	12
	High school	60	40
	Graduated	52	35
	Postgraduate	12	8

recruited on the basis of age and level of education. In addition, subjects were selected using predetermined screening criteria based on consumption frequency of chicken and organic products.

One hundred ninety-two subjects were interviewed and were asked their frequency of consumption of chicken at home (1 = never; 2 = once a year or less; 3 = 3 to 5 times a year; 4 = less than once a month; 5 = 1 to 2 times a month; 6 = more than twice a month; 7 = at least once a week).

The selected consumer panel included subjects who were reported to consume chicken at least 1 to 2 times a month and organic products occasionally. Subjects had a mean age of 49 yr and were almost equally distributed for sex. The main features of the subjects participating to the consumer panel are depicted in Table 2.

The experiment was planned in 3 tests (Table 3). In the first test the consumers were offered CC, OSG, and OFG in a balanced order of presentation. The consumers were asked to taste the meat and rate their liking when receiving no information on the products (perceived liking). In the second test, the subjects received 2 sheets with the information concerning the farming systems (conventional or organic). They were asked to read carefully the information and give their liking expectation for that product (expected liking). Only 2 types of information were given to consumers (conventional and organic) as resembling those available at the place of purchasing, where no supplementary information on the breed is usually provided. The first and second tests were performed on the same day. The day after the third test was performed: the consumers were given OSG and OFG only in a balanced order of presentation along with the information sheet. They were instructed to read the information before tasting the sample and express their liking score (actual liking). The CC was not offered to consumers in this information condition (actual liking) because the aim of the experiment was the assessment of the information about

organic production on chicken liking. In addition, no particular information is generally given on conventional chicken at the place of purchase. Therefore, these considerations along with economic constraints suggested that we omit this tasting.

Consumers rated their liking on a 9-point hedonic scale labeled at the left end with “extremely unpleasant,” at the right end with “extremely pleasant” and at the central point with “neither pleasant nor unpleasant” (Kähkönen et al., 1996).

In tests 2 (expectations produced by information) and 3 (acceptability generated by information and tasting of the product) the following information concerning the farming systems were given to consumers:

- 1) Conventional chicken: *conventional poultry farming ensure standards of animal welfare as set by the current legislation; the administration of pharmaceuticals is allowed within the suspension limits, as well as the use of GMO and chemicals for the production of animal feeds, in accordance with the current legislation; a high stocking density per hectare is allowed.*
- 2) Organic chicken: *organic poultry farming practices ensure standards of animal welfare higher than those set by the current legislation by promoting grazing systems and the expression of species-specific natural behavior; the use of pharmaceuticals is markedly reduced; the use of GMO and chemicals for the production of animal feeds is banned; stocking density per hectare is low to reduce the impact of farming on the environment.*

Statistical Analysis

Data were analyzed with Statistical Analysis Software (SAS, 1990, SAS Institute Inc., Cary, NC). Sensory analysis data gathered through quantitative-descriptive analysis were subjected to ANOVA with product,

Table 3. Summary of the experimental design for the assessment of consumer liking for chicken breast

Test	Day	Stimulus presentation	Type of evaluation	Type of rating
1	1	Chicken breast	Tasting without information	Blind
2	1	Information	Expectation	Expected
3	2	Chicken + information	Tasting with information	Actual

Table 4. Sensory profile of breasts from conventional (CC), organic fast-growing (OFG), and organic slow-growing (OSG) chickens assessed by a 10-member panel (mean \pm SEM)

Item	CC	OFG	OSG	<i>P</i> <
Tenderness	97.5 \pm 6.3 ^{A,a}	77.3 \pm 6.3 ^b	52.6 \pm 6.3 ^{B,c}	0.001
Initial juiciness	72.0 \pm 6.4	69.0 \pm 6.4	60.0 \pm 6.4	0.25
Final juiciness	70.1 \pm 5.7 ^a	69.9 \pm 5.7 ^a	54.5 \pm 5.7 ^b	0.05
Fibrousness	92.5 \pm 5.5 ^{A,a}	70.0 \pm 5.5 ^b	54.0 \pm 5.5 ^{B,c}	0.001
Residue	72.7 \pm 5.2 ^{A,a}	55.4 \pm 5.2 ^b	45.0 \pm 5.2 ^B	0.01

^{A,B}*P* < 0.001; ^{A,B}*P* < 0.01; ^{a-c}*P* < 0.05.

replication, and the interaction as factors. Because replication and the interaction replication \times product were not significant, they were removed from the analysis.

Perceived, expected, and actual liking scores along with disconfirmation and assimilation data were subjected to ANOVA with geographical location, age, sex, presence of children under the age of 6, and level of education as factors.

Data obtained in blind conditions were also subjected to ANOVA with 1 factor (product). The Student's paired *t*-tests were used to evaluate differences between liking mean scores either elicited (expected liking) by the 2 types of information (conventional and organic), or given to the 2 organic products (OSG and OFG) in informed conditions (actual liking).

For each organic product (OSG and OFG), liking scores obtained in different information conditions (tasting only, information only, tasting with information) were also subjected to ANOVA with 1 factor (information condition). The Student's *t*-test was used to compare the liking of single products under different information conditions.

RESULTS AND DISCUSSION

Quantitative-Descriptive Sensory Analysis

The sensory characteristics of the different products are reported in Table 4. Trained panelists were able to discriminate between products using most of the attributes. In particular, meat from CC was perceived as more tender than OFG (*P* < 0.05) and OSG (*P* < 0.001), more fibrous than OFG (*P* < 0.05) and OSG (*P* < 0.001), and leaving more residue than OFG (*P* < 0.05) and OSG (*P* < 0.001). Breast from the slow-growing strain, on the contrary, was assessed as less juicy before swallowing than OFG and CC (*P* < 0.05) and less fibrous and tender than OFG (*P* < 0.05). Accordingly, in a previous study Lawlor et al. (2003) observed that breasts from organic, corn-fed, free-range and conventional chickens could be clearly discriminated by a trained panel on the basis of product sensory attributes. Similar results were also obtained by Castellini et al. (2002b), Kishowar et al. (2005), and Husak et al. (2008). In general, birds reared under organic and free-range systems have a higher physical activity than conventional broilers. This may result in a different texture profile. In particular, Fanatico et al. (2007) observed

a lower degree of rupturing when chewing in breasts from chickens kept outdoors, which perfectly matches with our results on fibrousness, defined as the "extent to which fibres strands are perceived on chewing" and on the amount of residue remaining in the mouth after swallowing. Along with Castellini et al. (2002c) and Santos et al. (2005), outdoor-reared animals produce tougher and firmer meat as a possible consequence of increased physical exercise inducing a strengthening of the connective tissue structure. However, the effect of organic rearing system may be also related to genetic factors. In fact, according to Schütz and Jensen (2001), chickens selected for higher growth rates have progressively modified their behavior, reducing physical activity (Weeks et al., 2000; Castellini et al., 2002a; Dal Bosco et al., 2010), which is a main energy cost to the animals.

An et al. (2010) found that genetic differences in thickness of perimysium and endomysium between fast-growing chickens and slow-growing animals may have induced differences in meat texture. The higher age at slaughter of slow-growing animals may have induced a further reduction of tenderness in OSG breasts, as also observed by several authors (Castellini et al., 2002b; Wattanachant et al., 2004; Fanatico et al., 2005a). In addition, difference in tenderness and fibrousness between CC and OFG breasts (*P* < 0.05) may be, at least partially, explained by a possible higher lipid content in conventional breasts.

Our results on juiciness are in agreement with those obtained in previous studies reporting that breasts from slow-growing chickens were considered too dry possibly because of the smaller and thinner dimensions causing higher drip loss during cooking (Fanatico et al., 2005b); a reduced juiciness, however, may also be related to lower levels of tenderness (Zimoch and Gullett, 1997).

Consumer Liking

Ratings given by consumers are summarized in Table 5. No effect of the product was observed on liking expressed without information (blind condition); therefore, consumers expressed no preferences when liking was only based on tasting without information (*P* > 0.05). Consumers rated the 3 products above the central point (5 = neither pleasant nor unpleasant), thus indicating that both organic and conventional products displayed good sensory characteristics. The fact that

Table 5. Rating of breasts from conventional (CC), organic fast-growing (OFG), and organic slow-growing (OSG) chickens given by a 150-member consumer panel during the 3 hedonic tests (mean \pm SEM)

Type of rating	CC	OFG	OSG
Perceived (P)	6.5 \pm 0.5	6.3 \pm 0.5	6.3 \pm 0.5
Expected (E)	5.3 \pm 0.4 ^b	7.7 \pm 0.6 ^a	7.7 \pm 0.6 ^a
Actual (A)	NR ¹	6.8 \pm 0.6	6.8 \pm 0.6
P-E	1.19*** Positive disconfirmation	-1.43*** Negative disconfirmation	-1.43*** Negative disconfirmation
A-P	NR	0.55*** Assimilation	0.53*** Assimilation
A-E	NR	-0.88*** Incomplete	-0.90*** Incomplete

^{a,b} $P < 0.05$.

¹NR = not recorded.

*** $P < 0.001$.

the trained panel could discriminate between products, whereas consumers could not, is not surprising because the latter were untrained. Similar results were obtained by Lawlor et al. (2003). These authors were unable to show a clear preference pattern of consumers for 8 products from organic, free-ranging, and conventional chickens, whereas a trained panel used sensory attributes to distinguish 15 chicken breasts of different origins, including those rated by the consumers. Fanatico et al. (2007) confirmed these results, showing that an untrained consumer panel found no differences between the texture of slow-growing outdoor birds and fast-growing confined birds.

Effect of Information About Organic Production on Consumer Liking

Expected liking scores (Table 5) were above the central point for both the production systems (organic and conventional). For CC breast, a good expected liking may reflect the consumer trust in legislation and transparency of the conventional processes. However, consumers gave higher expected liking scores for organic than for conventional products ($P < 0.001$), thus indicating their awareness for the potential positive effects of organic farming on product quality and safety, as also suggested by Braghieri and Napolitano (2009). Accordingly, based on a conjoint analysis study, Martínez Michel et al. (2011) observed that consumers expressed a higher willingness to pay for chicken breast from free-range animals, and without additives and preservatives. No differences were observed between the 2 organic products (OSG and OFG) also when they were offered to the consumers in informed conditions (actual liking). This result is consistent with that obtained in blind conditions, as the products (OSG and OFG) offered to the consumers in blind conditions were paired with the same information about organic farming.

Consumers scored both OFG and OSG perceived liking (blind conditions) at significantly lower levels ($P < 0.001$) than expected liking (Table 5). This result indicates that a negative disconfirmation occurred. Conversely, CC chicken was found better than expected by consumers ($P < 0.001$), thus indicating that a positive disconfirmation occurred. These results may be indica-

tive of the potentially marked impact of information about organic farming on consumer expectancy. This is in agreement with previous studies showing an influence of positive information about farming practices on meat actual liking (Napolitano et al., 2010b) and willingness to pay for yogurt (Napolitano et al., 2008), whereas negative information about farming methods adversely affected consumer liking for lamb (Napolitano et al., 2007).

Actual liking scores (Table 5) were significantly higher than liking perceived in blind conditions for poultry meat produced according to the organic system ($P < 0.001$ and $P < 0.01$ for OFG and OSG, respectively). This result may be explained on the basis of the assimilation model (i.e., the actual liking of the product moves in the direction of the expectations), while confirming the positive impact of the information concerning the use of organic farming techniques (corresponding to high levels of animal welfare and product safety, and low impact on the environment) on actual liking for poultry meat. Although not measured in this study, according to the assimilation model the actual liking of CC might have moved toward the lower level expressed in terms of expectancy for the conventional product. However, a previous study showed that actual liking for an animal-based product with good eating quality (a good eating quality of the conventional product was observed in this study) moved toward the expectations (i.e., assimilation occurred) if paired with negative information, whereas it did not change significantly (i.e., assimilation did not occur) if the information provided to consumers was neutral (Napolitano et al., 2008).

In a previous study, Lawlor et al. (2003), based on data obtained using quantitative-descriptive sensory analysis, stated that chicken breasts from organic farming may not taste better than chicken breasts from conventional farming and concluded that this result could reduce consumer willingness to pay premiums for organic chicken over conventional prices. However, in this study we observed an increment of chicken breast actual liking in response to the information about organic farming. In addition, a positive, significant relationship has been detected between beef liking and willingness to pay by Napolitano et al. (2010b), who found that consumer willingness to pay reflected the hedonic be-

havior. These authors also noted that willingness to pay was more dependent on information than on product sensory properties. Accordingly, it has been observed that information on animal welfare (Vanhonacker and Verbeke, 2009) and organic production (Pouta et al., 2010) increased the likelihood of consumer choice for poultry products. Fresh meat, including chicken, is usually commercialized as an undifferentiated product. Because the food chain quality is related on both product and process characteristics, for organic poultry meat, process characteristics, represented by the farming practices and the related organic standards, may be more appropriate to differentiate the product, increase the market share, and possibly increase consumer willingness to pay over the cost of differentiation, given that the information provided to the consumers is paired with products presenting a good eating quality like those used in this study (consumers rated the products at scores above the central point). A previous study indicated that if the product is disliked, the information is unable to significantly increase consumer willingness to pay (Napolitano et al., 2008).

The relevance of sensory quality dimensions, which are used by consumers as a basis for their final judgments, is also indicated by the incomplete assimilation observed in this study for both organic products showing significant differences between actual and expected likings ($P < 0.001$).

We conclude that, based on the sensory characteristics of the products, trained panelists were able to discriminate chicken breasts from different sources on the basis of their texture-based sensory profile, whereas untrained consumers were not able to detect differences in product liking. However, consumer liking was markedly affected by the information given on the organic production system, thus providing a tool to differentiate the product in an increasingly competitive market.

Effect of Geographical Location on Consumer Liking

No effects of sex, age, education, and presence of children under the age of 6 were observed on liking scores, whereas geographical location affected perceived liking of CC and OSG, actual liking of OSG and the assimilation of OSG ($P < 0.05$). In particular, in blind conditions, consumers from central Italy (Ancona) rated CC higher than consumers from northern Italy (Udine), whereas in both blind (perceived liking) and informed conditions (actual liking) consumers from northern Italy gave higher scores to OSG than those from central Italy ($P < 0.05$). Because no differences between the expectancies for the organic products of consumers from different geographical locations were observed, the assimilation for OSG was higher for consumers from northern Italy than from any other locations ($P < 0.05$). Our data suggest that consumers from northern Italy preferred a less tender breast (OSG), and as a

consequence, they were able to express a higher degree of assimilation of OSG perceived liking toward the expectations. A previous study on yogurt showed that assimilation is facilitated by a high degree of acceptability (Napolitano et al., 2008).

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