MAPPING THE EFFECT OF INFORMATION ABOUT ANIMAL WELFARE ON CONSUMER LIKING AND WILLINGNESS TO PAY FOR YOGURT

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ABSTRACT

Preference mapping identified different groups of consumers on the basis of their disconfirmations (occurring when the product is either better or worse than expected) and assimilations (occurring when actual liking [L] moves toward the expectations). The negative disconfirmation of a group of consumers (Group 1) was based on the information about animal welfare (the products were worse than expected because the information about animal welfare induced high expectations), whereas in Group 2 the sensory properties of the products prevailed in orienting consumer disconfirmation (products were worse than expected because the sensory properties of low-fat yogurt were disliked). The map of assimilation showed that consumers from Group 1 had higher assimilation for plain yogurt associated with high welfare standards as a consequence of the high discrepancy between blind and expected L for these products. A similar behavior was observed for Group 2 (higher discrepancy between blind and expected L corresponding to higher assimilation for low-fat yogurt paired with high welfare standards).

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PRACTICAL APPLICATIONS

Consumers based their choices both on sensory properties (plain yogurts were preferred to low-fat yogurts) and on information about animal welfare (products associated with high welfare standards were preferred to the others). Preference mapping was able to identify groups of consumers behaving differently, as compared with the general trend, on the basis of their disconfirmations and assimilations.

Consumer willingness to pay reflected the hedonic behavior, thus validating the auction procedure for food liking evaluation purposes and providing a useful tool to obtain information about the real value (i.e., in monetary terms) consumers give to animal welfare.

INTRODUCTION

In western countries, dairy enterprises are facing a progressive saturation of markets, which are consequently becoming very competitive. Although from a strict economic point of view, the values of animal welfare are negative, inducing unmitigated costs to consumers and producers, they may represent for dairy farms a potential tool to differentiate products and increase competitiveness without increasing production efficiency. Consumers from western countries are acquiring an increasing interest in farming practices and the related animal welfare standards. In a study done by the European Commission in 2007, European consumers were asked to rate the importance of farm animal protection on a scale ranging from 0 to 10. The majority of consumers answered toward the high end of the scale with a mean score of 7.8. In response to this public endorsement, an increasing number of regulations have been issued on the welfare of farm animals. In North America, livestock welfare has traditionally been an area for industry self-regulation. However, Swanson and Mench (2000) noted that a number of opinion polls revealed public interest in the way farm animals are raised. The public drive toward increased farm animal welfare standards suggests that consumers from western countries may be willing to pay the extra costs linked to increased levels of animal welfare.

Quality dimensions of dairy products have been classified into hedonic (related to sensory properties), health (concerning chemical composition), convenience (such as conservation, time and ease of preparation, etc.) and process aspects (Grunert *et al.* 2000). The latter may be of interest to consumers either because process characteristics can affect some of the other quality dimensions or because they are related to ethical issues such as environmental concerns, animal welfare, etc. Most of the previously mentioned quality attributes of many dairy products (e.g., yogurt) cannot be ascertained before or

while purchasing and in order to take a decision on whether buying or not, consumers have to form quality expectations (Olson and Jacoby 1972). Therefore, credence characteristics acquire particular relevance for these products and, although should be communicated to be perceived, they are able to confer benefits to the consumers as believed to be true. In this case, expectations are constructed on the basis of the information available at the time of purchase (Grunert *et al.* 2000).

When product quality becomes a matter of communication, with no means of confirming or disconfirming the message by own experience, three main aspects have to be considered: credibility of the source of information, consumer motivation and ability to process the information (Petty *et al.* 1991). Therefore, the information given to consumers should be based on real data concerning production systems where their ethical concerns about animal welfare are really addressed. If consumers trust the information, it becomes more useful and will be in higher demand (Grunert *et al.* 2000). Harper and Henson (2001) observed that consumers are willing to receive more information about farming methods to make informed choices, while the majority of respondents to a survey conducted within European Union stated that they were very rarely or never able to identify products obtained using animal welfare friendly production systems because no information was provided (European Commission 2005).

Previous studies have been conducted on the effect of information about animal welfare on lamb (Napolitano *et al.* 2007a) and beef liking (Napolitano *et al.* 2007b). These experiments showed that expectations induced by the information on animal welfare were able to affect the quality perception of meat: the expectations were positively (the liking [L] score of the product tasted without external information was higher than expected) or negatively disconfirmed (the product was worse than expected) in line with the information given to the consumers. According to the assimilation model, product L moves in the direction of expectations when tasted with information (Anderson 1973; Cardello and Sawyer 1992). In Napolitano *et al.*'s studies, the assimilation model was generally applicable as in both cases, the hedonic ratings moved toward the expectations when the information concerning animal welfare was given, as compared with tasting without external information. The consumption of yogurt, a food already considered to be healthy, can also benefit from messaging and promotion: Schifferstein *et al.* (1999) observed a significant effect of the expectations induced by information on yogurt quality judgment and purchase intent. Accordingly, a recent study on willingness to pay (WTP) for yogurt showed that consumers were influenced by information about low standards of animal welfare and moved their WTP in the direction of their expectations. However, the discrepancy between expectancy and actual WTP was not totally assimilated, indicating that WTP was also

expressed in relation to other aspects such as the sensory properties of the products (Napolitano *et al.* 2008).

Differences among consumers are of fundamental interest as it is more effective to treat certain types of consumers in different ways than to treat all of them in the same way. As for sensory properties, consumers respond differently to nonsensory variables, therefore, it is important to study the behavior of groups of consumers rather than overall tendencies (Guinard *et al.* 2001). A number of segmentation techniques, based on different types of information (e.g., acceptability data, geography, demographics, behavior variables), can be applied to identify different groups of consumers (Vigneau *et al.* 2001; Santa Cruz *et al.* 2002; Jaeger *et al.* 2003; Thybo *et al.* 2004).

In this study, consumer segmentation techniques were aimed at identifying clusters of consumers differently affected by the information about animal welfare in terms of yogurt L and WTP. In particular, internal preference mapping was used to study different behaviors in terms of disconfirmation and assimilation as induced by sensory variables and information on animal welfare. Internal preference mapping refers to the analysis of preference data only and provides a summary of the main preference directions and the associated consumer segments (see MacFie 2007). The space of representation is obtained from preference data applying principal component analysis (PCA) and considering the consumers as variables.

Intent to pay animal food products is often measured through questionnaires (Dransfield *et al.* 2005; European Commission 2005), but these measurements may be not representative of the real behavior of consumers. Rather, WTP should be assessed in a condition where a potential purchase performed by consumers, such as the Vickrey auction, is included, as they are placed in a real situation where their true preferences can be detected (Vickrey 1961). In costly and festive food products, Lange *et al.* (2002) observed that hedonic measures may be more appropriate for the assessment of the sensory value attributed by consumers to the product, whereas WTP may be more sensitive for the evaluation of the perceived value of a product tested in the presence of external information. Therefore, the effect of information on animal welfare was studied on both hedonic and WTP condition in order to assess the appropriateness of the two methods in studying the behavior of consumers for a food commodity such as yogurt.

MATERIALS AND METHODS

Products

Two commercial products from the same producer were used: plain yogurt (PY) with 4.8, 4.0 and 3.5% protein, sugar and fat contents,

respectively, and low-fat yogurt (LFY) with 4.0, 5.1 and 0.1% protein, sugar and fat contents, respectively.

Subjects

Subjects were recruited in Potenza (main town in the region of Basilicata, southern Italy). One hundred thirty-five subjects were interviewed and were asked their frequency of consumption at home (1 = never; 2 = less than once a week; 3 = once a week; 4 = more than once week; 5 = once a day) and family income. The consumer panel consisted of 104 subjects selected on the basis of age (19–34 years), level of education (at least high school diploma) and consumption frequency of yogurt (at least once a week). Subjects were mainly students with a mean age of 24 years, as in previous research (Grunert and Valli 2001), young subjects with a higher level of education fell within a segment of consumers defined as "concerned about animal welfare." In addition, consumers were asked to fill in a questionnaire in order to assess their sensitivity to various aspects of animal welfare, as suggested by Napolitano *et al.* (2008). The questionnaire consisted of statements, which were positive or negative in terms of animal welfare. These statements were presented to the subjects in an alternate order to avoid a carryover effect. Consumers were asked to rate their degree of agreement with positive statements, such as "Farm animals are sentient beings," "Farm animals should be raised in natural conditions," and negative statements, such as "In farming practices, production efficiency is more important than animal welfare," "Mutilations (beak trimming, dehorning, etc.) represent a useful tool for increasing production efficiency," etc., presented in alternate order. Subjects expressed their degree of agreement on a 7-point scale labeled at the left end with "I do not agree," at the right end with "I do agree" and at the central point with "I neither agree nor disagree," the latter corresponding to the score 4. Scales for positive and negative statements were used by consumers in the same direction. Subsequently, scores were attributed following an increasing trend for positive statements (1 to 7), whereas a decreasing trend was used for negative statements (7 to 1). The mean scores of the subjects participating to the study ranged from 3.8 to 6.9, indicating a fair sensitivity to animal welfare issues.

Experimental Design and Information Provided to Consumers

Although previous studies demonstrated that bids do not affect a previous or concomitant hedonic assessment (Noussair *et al.* 2004; Poole *et al.* 2007), in this study, the second price Vickrey auction was conducted 1 week after hedonic tests. Both evaluations hedonic and WTP were planned in three sessions (Table 1). In the first session, the consumers were offered both PY and LFY in a balanced order of presentation. They were asked to taste the product

TABLE 1.
SUMMARY OF THE EXPERIMENTAL DESIGN FOR THE ASSESSMENT OF CONSUMER
LIKING (L) AND WILLINGNESS TO PAY (WTP)

Session	Day	Stimulus presentation	Type of evaluation	Type of rating
1	1	Yogurt	Tasting without information	Blind L and WTP
2	1	Information	Expectation	Expected L and WTP
3	2	Yogurt + information	Tasting with information	Actual L and WTP

and, subsequently, to rate their L or WTP receiving no information (no information sheet, no labels) on the products (blind L and blind WTP). In the second session, the subjects received the information sheet and the products labeled with the information concerning the welfare conditions of the animals in terms of body cleanliness and locomotion. They were asked to read carefully the information and give their L or WTP expectation for that product without tasting it (expected L and WTP). First and second sessions were performed on the same day. The day after the third session was performed: the consumers were given both products (PY and LFY) labeled along with the information sheet. They were instructed to read both the information sheet and the labels before tasting the sample and express their L or WTP immediately afterward (actual L and WTP).

In sessions 2 (expectations produced by information in terms of L and WTP) and 3 (actual L and WTP generated by information and tasting of the product), consumers were provided with labels and an information sheet explaining their meaning. The information given to the consumers was based on a recent study where lay people were asked to watch videos of dairy cattle raised according to the most common housing systems in use, i.e., cubicles (CU), straw yards (SY) and tie stalls (TS), and elicit terms describing how they perceived the observed farming systems to affect cattle welfare (Napolitano *et al.* 2007c). Two main dimensions of animal welfare were identified by pairing free choice profiling and generalized Procrustes analysis techniques: cleanliness and freedom of movement. The statistical analysis indicated that CU farms received high scores for both cleanliness and freedom of movement, while SY farms were high in freedom of movement and low in cleanliness, and TS were low in both freedom of movement and cleanliness. In order to complete the set of information, a fourth fictitious condition corresponding to farms high in cleanliness and low in freedom of movement was added (FC). Thus, the following explanation was given to the consumers through the information sheet:

Today you will receive eight products obtained from eight different farms. Several aspects can be taken into account to assess animal welfare at farm level. However, only two main aspects relevant to animal welfare were

assessed in these farms: freedom of movements and body cleanliness. These aspects are solely related to the animals and do not affect food safety, which is guaranteed for all products. The results of the on-farm welfare assessment are reported on the labels under the form of stars, as indicated below:

★★★★★ = *Very good*
★★★★☆ = *Good*
★★★☆☆ = *Sufficient*
★★☆☆☆ = *Insufficient*
★☆☆☆☆ = *Poor*

Four labels, corresponding to four combinations cleanliness/freedom of movement were used:

Cleanliness ★★★★★, freedom of movement ★★★★☆ (corresponding to farms CU)
Cleanliness ★☆☆☆☆, freedom of movement ★★★★★ (corresponding to farms SY)
Cleanliness ★★★★★, freedom of movement ★☆☆☆☆ (corresponding to farms FC)
Cleanliness ★★☆☆☆, freedom of movement ★☆☆☆☆ (corresponding to farms TS)

Hedonic Test, Vickrey Auction and Data Acquisition

Consumers were asked to express their L by rating the products on a 9-point hedonic scale labeled at the left end with "extremely dislike," at the right end with "extremely like" and at the central point with "neither like nor dislike," the latter corresponding to the score 5 (Kähkönen *et al.* 1996).

The second price Vickrey auction (Vickrey 1961) was used to assess consumer WTP yogurts according to the level of welfare of the animals used in the production process. Participants attended a short presentation explaining the procedure to be followed for the auction. It was made clear that the submission of bids implied a commitment to buy the product. Participants agreeing to the procedure signed a consent form and received 10 euro in cash. Subsequently, a formal training on the use of the Vickrey second price auction was conducted. It was explained that, for each product, the maximum price accepted to pay for one unit of product had to be written on paper, separately by each participant. The participant submitting the highest price (winner) had to buy the product, not at the submitted price, but at the second highest price (i.e., the second highest submitted bid). This procedure allowed one of the participants to buy a product at a price lower than or equal to the price they would normally accept to pay. It was also explained that the study aimed to know the value that the product had for the consumers, not its commercial

value, and that the best option for them was the submission of their real reservation price. In order to ascertain that all participants correctly interpreted the procedure, some practice was conducted using snacks. Subsequently, the three tests were conducted: it was explained that yogurts would be evaluated under different information conditions and only one condition, randomly chosen by a consumer, would be used as the actual auction. This procedure was used to prevent winners from becoming less motivated in winning more products.

Data Analysis

Differences between mean hedonic scores and differences between mean WTP ratings obtained for the two yogurts by 104 consumers in blind condition (tasting only without information) were assessed using a Student's paired *t*-test. Similarly, Student's paired *t*-test was used to evaluate differences between mean expected hedonic scores and differences between mean expected WTP ratings.

In order to study actual L and actual WTP on homogeneous groups of consumers, internal preference mapping was carried out on the hedonic and WTP ratings produced by consumers when tasting with information. A matrix of 104 variables (the consumers) and eight objects (two yogurts × four types of information) was built for each experiment. The resulting preference maps describe variations between objects based on the consumer actual Ls and actual WTP.

In order to study the disconfirmation and assimilation effects on homogeneous clusters of consumers, additional internal preference mapping was carried out. For disconfirmation, the analysis was applied on the difference in hedonic ratings between the expected and blind L and on the difference between expected and blind WTP. For assimilation, the analysis was applied on the difference between actual and blind L and on the difference between actual and blind WTP. Internal preference mapping was carried out using the statistical package SIMCA-P (Version 11.0; UMETRICS, Umea, Sweden).

In order to characterize the clusters of consumers in terms of sociodemographic and attitudinal variables, the income, use frequency and sensitivity to animal welfare variables were projected as vectors on assimilation preference map. The coordinate ends were the correlation coefficients between the values attributed to the variables for each consumer and the coordinates of the consumers along the first and second dimension of the assimilation map. For the variable "income," two classes were used: $1 = $ low income, $2 = $ high income; for "use frequency" and "sensitivity to animal welfare" variables, three classes were used: $1 = $ low, $2 = $ medium, $3 = $ high use frequency and sensitivity, respectively.

For each session (blind, expected and actual conditions), the relationship between product L and consumer WTP was calculated using the Spearman's correlation coefficient (r_s).

RESULTS AND DISCUSSION

In all sessions (blind, expected and actual conditions), the relationships between product L and consumer WTP (Table 2) were significant ($P < 0.01$). However, the level of statistical significance of the correlation says little about the degree of association between variables, as significance also depends on the sample size, whereas the value of the correlation coefficients is much more informative. A valid method to assess the reliability of correlations is by using the square of the correlation coefficients, which represent the determination coefficients. The latter indicate the proportion of variation in one set of scores that is explained by the other set of data. In our study, only in three occasions the correlation coefficients were below 0.4, whereas in most cases, they exceeded 0.5, thus indicating that more than 25% of variance in one set of data is accounted for by the variation in the other measure ($0.5^2 = 0.25$). Therefore, both variables can be used to study the effect of information on consumer behavior.

Blind acceptability was higher for PY (5.82 ± 0.19) than LFY (4.79 ± 0.17; $P < 0.001$). In particular, consumers rated the former product above the central point (5 = neither liked nor disliked) and the latter below it. Accordingly, blind WTP was higher for PY (0.56 ± 0.03) than LFY (0.43 ± 0.02; $P < 0.001$). This result is likely to be due to the different

TABLE 2.
RELATIONSHIP (r_S) BETWEEN YOGURT LIKING (L) AND CONSUMER WILLINGNESS TO PAY (WTP) WITHIN EACH SESSION (BLIND, EXPECTED, ACTUAL CONDITIONS)

Product	Blind	Expected	Actual
PY TS	0.71	0.58	0.71
LFY TS	0.53	0.50	0.61
PY SY	0.71	0.59	0.67
LFY SY	0.53	0.56	0.60
PY FC	0.71	0.30	0.47
LFY FC	0.53	0.34	0.75
PY CU	0.71	0.44	0.67
LFY CU	0.53	0.38	0.71

CU, cubicles, SY, straw yards; TS, tie stalls; FC, fictitious condition; PY, plain yogurt; LFY, low-fat yogurt.

TABLE 3.
MEAN EXPECTATIONS (±STANDARD ERROR)
GENERATED BY FOUR INFORMATION CONDITIONS IN
TERMS OF LIKING AND WTP

Information condition	Liking	WTP
TS	2.76 ± 0.12	0.27 ± 0.02
SY	3.72 ± 0.12	0.34 ± 0.02
FC	5.91 ± 0.12	0.54 ± 0.02
CU	7.81 ± 0.12	0.81 ± 0.02

CU, cubicles, FC, fictitious condition, SY, straw yards; TS, tie stalls.

chemical composition of the two products, which in turn affected their sensory properties: low-fat products show reduced creaminess and flavor, which can only partly be replaced by added sugar solids (Rash 1990).

Differences among expected hedonic and WTP scores, corresponding to the four information conditions, were all significant ($P < 0.01$) with the highest expectations for CU and the lowest for TS in terms of acceptability and WTP (Table 3). These results show that consumers are aware of the possible negative effects of low animal welfare standards on product quality and safety while expecting a higher quality from products obtained using animal welfare friendly systems. Our study confirms previous data based on focus groups stating that consumers use animal welfare as an indicator of other product attributes such as food safety, food quality and food healthiness (Harper and Henson 2001). Consumers also showed higher expectations for FC than SY ($P < 0.001$); therefore, it can be hypothesized that they consider animal hygienic conditions more relevant than the expression of natural behavior in relation to acceptability and WTP.

The internal maps depicted in Figs. 1–3 are bi-plots from PCAs and they can be interpreted using consumers as vectors and products as cases. Therefore, the relationship between products and consumers (i.e., the L order of the products) is based on the order of the projects of the products onto the consumer vector in the bi-plots.

The map of actual L (Fig. 1) shows a single group of consumers reacting homogeneously to the eight combinations product/information. In fact, it is located at the right end of the first dimension that explained 46% of variance. Conversely, the second dimension explained the 15% of variance. The map clearly shows that the consumers preferred PY and rejected LFY, although their choice was also affected by welfare standards, as the most liked product was PY–CU (combination of PY with the highest welfare standards) followed by PY–FC, PY–SY and then PY–TS, while LFY–TS and LFY–SY (combination of LFY with the lowest welfare standards) were the most disliked. As
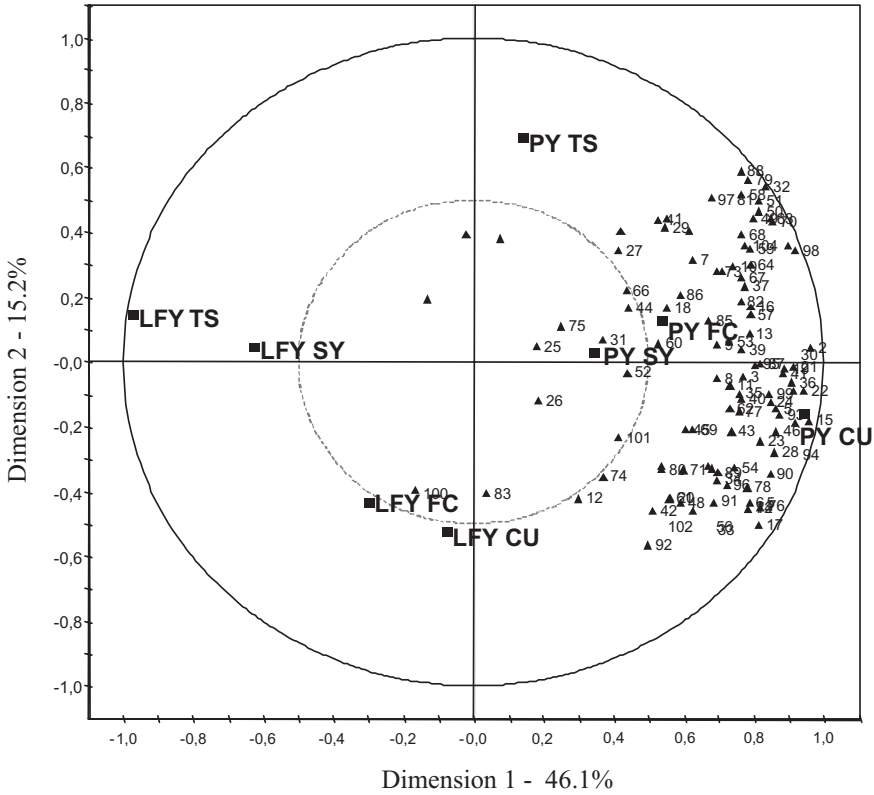
FIG. 1. INTERNAL PREFERENCE MAP OF ACTUAL LIKING
PY, plain yogurt; LFY, low-fat yogurt; SY, straw yards; TS, tie stalls; CU, cubicles;
FC, fictitious condition.

expected, the map of actual WTP (variance explained by the first and second
dimensions were 44 and 16%, respectively) is comparable with that of actual
L (data not shown) as it yielded the same results in terms of consumer
clustering (i.e., only one group can be identified) and product differentiation
(WTP highest for PY–CU and lowest for LFY–TS and LFY–SY).

    Preference mapping built on differences between expected and blind L
was used to study the disconfirmation on homogeneous cluster of consumers
(Fig. 2). Figure 2 shows that all the consumers were located at the positive end
of the first axis (69% of explained variance); thus, the products associated with
high welfare standards were negatively disconfirmed (PY–CU followed by
LFY–CU and then by LFY–FC), which means that the products were worse
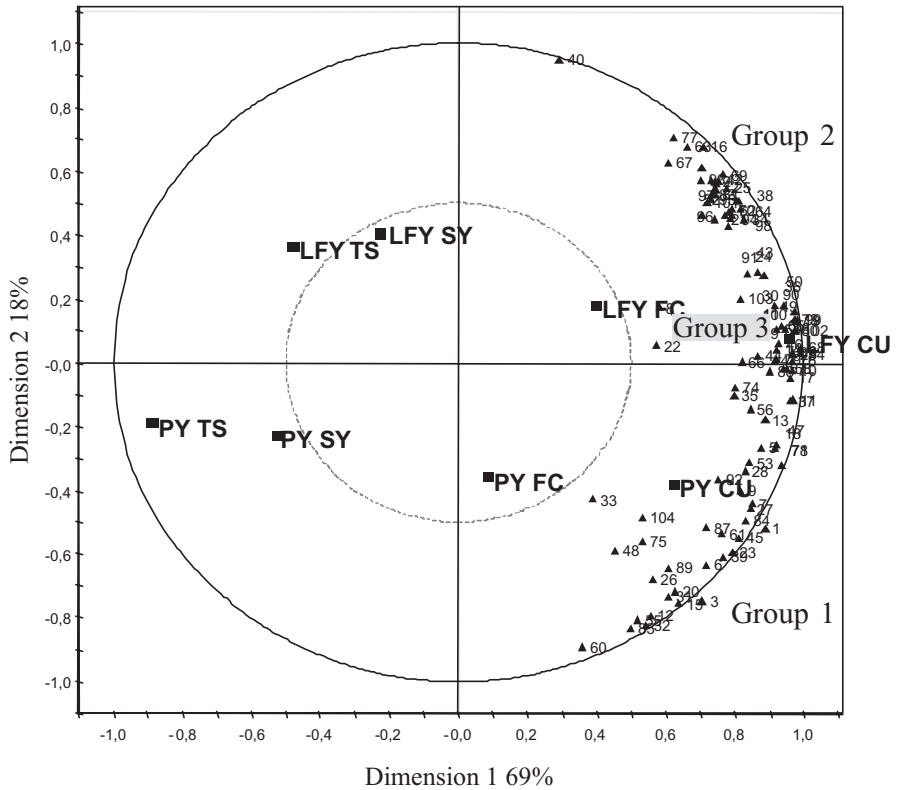than expected, whereas those coupled with low welfare standards were posi-

FIG. 2. INTERNAL PREFERENCE MAP OF DISCONFIRMATION (DIFFERENCES IN
HEDONIC RATINGS BETWEEN EXPECTED AND BLIND TASTING)
PY, plain yogurt; LFY, low-fat yogurt; SY, straw yards; TS, tie stalls; CU, cubicles;
FC, fictitious condition.

tively disconfirmed (PY–TS followed by PY–SY and LFY–TS), thus indicat-
ing that the L scores of the products tasted without external information were
higher than expected. In terms of disconfirmation, only PY–FC was not well
discriminated along the first dimension. However, the map (Fig. 2) provided
additional information. On the second axis (18% of explained variance), two
groups of consumers could be distinguished. Group 1 (31 consumers) was
located in the down right-hand side of the map and showed higher negative
disconfirmations for both PY–CU and LFY–CU, followed by PY–FC and then
by LFY–FC. Therefore, consumers did not discriminate products with differ-
ent sensory properties (PY and LFY) paired with the same information (high
welfare standards). Thus, in case of negative disconfirmation, Group 1 was
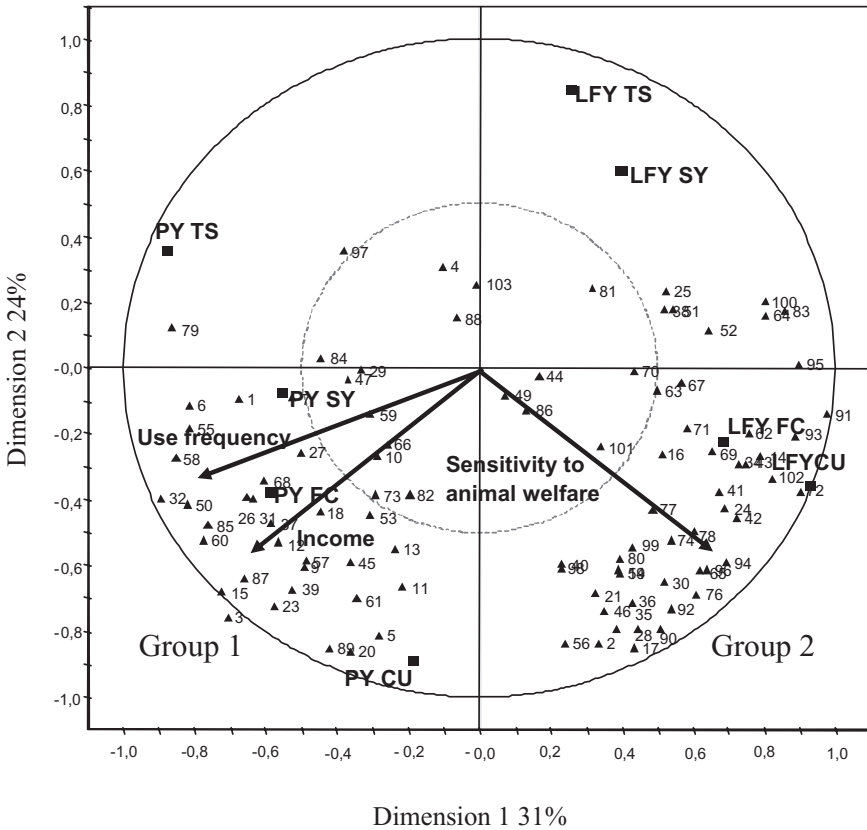primarily driven by the information on animal welfare in product discrimina-

FIG. 3. INTERNAL PREFERENCE MAP OF ASSIMILATION (DIFFERENCES IN HEDONIC
RATINGS BETWEEN INFORMED AND BLIND TASTING)
PY, plain yogurt; LFY, low-fat yogurt; SY, straw yards; TS, tie stalls; CU, cubicles;
FC, fictitious condition.

tion. The same group of consumers (Group 1) showed high positive discon-
firmations for LFY–TS and LFY–SY and then for PY–TS and PY–SY,
corresponding to the same products paired with different information condi-
tions. Thus, in case of positive disconfirmation, Group 1 was primarily driven
by the sensory properties in product discrimination. Group 2 (33 consumers)
was located in the up right-hand side of the map (Fig. 2). Consumers displayed
higher negative disconfirmations for LFY–CU and LFY–FC followed by
PY–CU and then by PY–FC. In this case, consumers from Group 2 did not
discriminate yogurts with the same sensory properties paired with the two
different information conditions. Group 2 also showed higher positive discon-

firmations for PY–TS and PY–SY followed by LFY–TS and LFY–SY, again discriminating the products predominantly on the basis of their sensory properties. In Fig. 2a, third group (Group 3, 40 consumers) was observed, corresponding to consumers significant only on the first axis, thus following the general trend in terms of disconfirmation. They showed higher negative disconfirmations for LFY–CU than PY–CU and LFY–FC, and higher positive disconfirmations for PY–TS than PY–SY. Therefore, preference mapping was able to identify groups of consumers behaving differently on the basis of their negative and positive disconfirmations.

The map of assimilation, built on differences between actual and blind L, perfectly matched that of disconfirmation in terms of group identification (Fig. 3). In fact, Group 1 and 2 could be clearly discriminated along the first dimension (31% of explained variance). In particular, Group 1, located in the down left-hand side of the map, displayed higher assimilations for PY paired with CU and FC, and no assimilation for LFY–TS and LFY–SY, whereas Group 2, located in the down right-hand side of the map, assimilated for LFY paired with CU and FC, while not assimilating for PY–TS. However, the consumers labeled in the disconfirmation (expected – blind) map as Group 3, were not homogeneously located in the assimilation (actual – blind) map: 17 consumers were not significantly fitted by the model (they were located at the center of the map), 19 were located in the down right-hand side, thus assimilating as the consumers from Group 2, and eight consumers were located in the down left-hand side, thus assimilating as the consumers from Group 1. Therefore, two groups of consumers were identified on the basis of their different assimilation behaviors. In addition, although on the first dimension, the assimilation expressed by Groups 1 and 2 could be explained by the sensory properties of the product rather than by the information conditions, on the second dimension (24% of explained variance), a single considerable group could be observed, showing no or little assimilation for products associated with low welfare standards (LFY TS, LFY SY, PY TS).

Previous studies reported that consumers are more likely to move their L in the direction of expectation as a consequence of negative disconfirmation rather than after positive disconfirmation (Deliza and Macfie 1996; Siret and Issanchou 2000; Caporale and Monteleone 2004). Accordingly, Fig. 3 shows an evident assimilation for products paired with information concerning high animal welfare standards corresponding to yogurts characterized by negative disconfirmations (Fig. 2).

Figure 3 shows as vectors the projections of sociodemographics variables on the first two dimensions of the map. Informed preferences were significantly affected by "family income," "frequency of consumption" and "sensitivity to animal welfare issues." In particular, "family income" and "frequency of consumption" were higher in Group 1, whereas Group 2 was represented by

consumers more "sensitive to animal welfare issues." The higher sensitivity to animal welfare may have induced the consumers from Group 2 to increase their L even when a disliked product (LFY) was offered, whereas consumers with higher income and frequency of consumption (Group 1) were willing to assimilate only when information about high standards of animal welfare were paired with products characterized by high eating quality (PY).

The preference maps built on WTP ratings in order to study disconfirmation (variance explained by the first and second dimensions were 70 and 16%, respectively) and assimilation (variance explained by the first and second dimensions were 33% and 25%, respectively) for homogeneous clusters of consumers are not presented as they showed results similar to those obtained in the preference mapping built on L ratings.

Although hedonic test and Vickrey auction were different in terms of rating scale, training and influence of the behavior of a consumer on the behavior of the others, maps on WTP displayed results similar to those obtained on L, thus indicating that both approaches are appropriate for consumer segmentation studies, as also stated by Lange *et al.* (2002). Consumer WTP reflected the hedonic behavior, thus validating the auction procedure for food L evaluation purposes. As hedonic tests require less time, training and money than auctions, it could be argued that the former can be considered reliable and more feasible to assess the value that consumers give to a food product. However, previous studies only showed that expectations induced by the information on animal welfare were able to affect product L (Napolitano *et al.* 2007a,b), whereas no information about the real value (i.e., in monetary terms) consumers give to animal welfare was provided. Conversely, auctions are able to give this important information and, at bids close to 0, they can indicate the complete unwillingness to buy a product.

CONCLUSION

The map of actual L clearly shows that the consumers based their choices both on sensory properties (PYs were preferred to LFYs) and on information about animal welfare (products associated with high welfare standards were preferred to the others). As a consequence, the most liked product was PY–CU, combination of PY with the highest welfare standards.

Preference mapping was able to identify groups of consumers behaving differently, as compared with the general trend, on the basis of their disconfirmations. For instance, the negative disconfirmation of Group 1 was mainly based on the information about animal welfare (the products were found worse than expected because the information about animal welfare was able to induce high expectations), whereas in Group 2, the sensory properties of the

products prevailed in orienting consumer disconfirmation (products were found worse than expected because the sensory properties of LFY were disliked). The map of assimilation matched that of disconfirmation in terms of group identification. In Group 1, the information about high animal welfare standards affected more PY L, whereas in Group 2, the effect of information about high animal welfare standards was more evident on LFY. This result can be explained on the basis of their different disconfirmations. Consumers from Group 1 showed a higher assimilation for PY associated with high animal welfare standards as a consequence of the higher discrepancy between blind and expected L for these products. A similar behavior was observed for Group 2 (higher discrepancy between blind and expected L corresponding to higher assimilation for LFY paired with high animal welfare standards).

Consumer WTP reflected the hedonic behavior, thus validating the auction procedure for food L evaluation purposes and providing a useful tool to obtain information about the real value (i.e., in monetary terms) consumers give to particular aspects, such as animal welfare.

ACKNOWLEDGMENTS

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