Recalled preference of Spanish consumers for smoked food

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Abstract
The aim of the present study was to reveal if sensory properties of smoked food could be considered as decisive in the determination of one product’s preference over another. In addition to this, this work tries to clarify whether the flavour obtained in commercial smoked products was noticed and clearly recognized. This study consisted of two parts; first, a preference testing without physical products (recalled preference) presented using a nine-point hedonic scale, and second, a difference testing with selected products using the triangular test. Consumers showed a preference for non-smoked products, particularly for cheese, sausages and chips. The first preference dimension of the internal preference mapping (MDPREF) analysis accounted for 74.6 per cent of total variation indicating overall agreement about likings relating these products, with cheese being the most acceptable overall. Analyzing triangular test results it may be concluded that other factors but sensory ones must be defining consumer representations of smoked food, without a correspondence with its real organoleptic properties.

Introduction
The age-old art of smoking foods was already well established a few thousand years ago. Smoking together with drying and salting belongs to the oldest food preservation methods highly suited to the relatively primitive conditions of the past (Barylko-Pikielna, 1977).

Although the bacteriostatic and antioxidative properties of smoke and smoke flavourings are the subject of current research (Schwanke et al., 1996; Wendorff and Wee, 1997) in modern food technology, the smoke-curing or smoke flavouring process has changed from its previous principal objective and should be considered primarily as a flavouring operation (Pszczola, 1995).

Preference for food products is only a part of the reason for food choice and is affected by endogenous (heredity, sex, age, etc.) and exogenous (culture, society, economy, etc.) factors of importance for food consumption (Risvik, 1994). Although preference is not considered a good predictor for repeated consumption, product sensory attributes are considered to be decisive in the determination of one product’s preference over another.

If the sensory attributes are important in consumer acceptance, they are doubly so for smoked foods (Lesimple et al., 1995). In fact, the smoke flavour is used, in many cases, as a novel flavour in several products, contributing desired sensory properties such as coloration (Riha and Wendorff, 1993), texture (Suzuki et al., 1997) and flavour (Helgesen and Naes, 1995). After all, it is the distinctiveness in this regard that is responsible for the continued and increasing demand for smoked foods, even in countries without a tradition of these commodities.

Preference mapping is a form of multivariate scaling that allows the identification of each individual and their relative preferences for, or relationship to, a particular set of stimuli (McEwan, 1996). It is used to answer a number of questions relating to improving the acceptability of the sensory aspects of a product. In the food industry, multivariate
scaling methods and in particular internal preference mapping (MDPREF) have been applied in a variety of areas: meat product evaluations (Marketo et al., 1994), acceptability of different types of drinking water (Falahhee and MacRae, 1995), fresh apples characterization (Daillant-Spinnler et al., 1996), optimization of a peach nectar formulation (Pastor et al., 1996).

The aim of the present study was to reveal if sensory properties of smoked food could be considered as decisive in the determination of one product’s preference over another. In addition, this work tries to clarify whether the flavour obtained in commercial smoked products was noticed and clearly recognized as what was being sold: a smoked food.

Methods and materials

This work consists of two parts; first, a preference testing without physical products presented using a nine point hedonic scale, and second, a difference testing with selected products using the triangular test.

Study 1. Preference questionnaire

The panel consisted of 300 persons among students, faculty and staff at the Facultad de Farmacia in the Basque Country University; 30 per cent were students and the rest staff.

For the first part of this work, a questionnaire based on the scale developed by Peryam and Pilgrim (1957) and the Product Attitude Survey suggested by Stone and Sidel (1993) was designed. Consumers were asked to rate different kinds of food (cheese, smoked cheese, smoked curd, sausages, smoked sausages, bacon, lard, smoked chorizo, salami, smoked salmon, smoked sardine, smoked herring, chips-snacks and smoked chips-snacks), with special emphasis on smoked ones, on a nine-point hedonic scale for overall preference (1 = dislike extremely; 5 = neither like nor dislike; 9 = like extremely). Questionnaires were given to the candidates to be filled at their own homes.

The assessment of smoked foods did not include tasting the products, this way the so-called “recalled preference” could be evaluated. Standards were not provided because they might have altered the representations people had of the concept, thus subjects made their judgements using their own past experiences with smoked products.

Study 2. Difference testing

It was intended to select smoked commodities belonging to fish, meat, vegetable and dairy products. Samples of cheese, salmon pâté, chips and sausages, smoked and non-smoked were purchased from local supermarkets in Vitoria (Spain). Care was specially taken that samples were exactly the same in all aspects except for the smoked character (same brands).

Salmon pâté was selected because the direct presentation of salmon, sardine or herring to consumers was impossible. These types of products are generally consumed after a cooking process, thus another variable had to be considered. In order to simplify this approach, and taking into account the high consumption of these foods, salmon pâté was found adequate and representative of fish products.

After purchasing they were stored at 7°C until required and held at ambient temperature for two hours before sensory evaluation. Samples, randomly coded, a glass of water and a cracker were distributed to the consumer group. These tests were carried out in purpose-built sensory booths. Panelists were asked to distinguish among the samples and if so to characterize these differences using the triangle test method (Stone and Sidel, 1993).

Data analysis

Study 1. Preference questionnaire

ANOVA was used and differences between means were tested using Fisher LSD (least significance difference) test (p < 0.05).

The Taguchi’s signal to noise ratio (SNR) was calculated according to Gacula (1993): \[ \text{SNR} = -10 \log \left( \frac{1}{y^2} \left(1 + 3s^2/y^2 \right) \right) \]
where \( y \) and \( s^2 \) are sample mean and variance respectively.

Because consumers will give an individual response, it is questionable to assume that a single group behavior among them is present and use such averaging procedures, thus preference data were input to MDPREF using PC-MDS Multidimensional Statistic Package (Smith, 1990). In this run of the analysis, each consumer’s acceptability data were pre-treated by subtracting the row mean and dividing by the standard deviation (z scores) and then scaled each consumer’s preference vector to unit variance (McEwan, 1996). This treatment was done in order to ensure that the scores of each consumer were given equal
weight. In order to perform the analysis, missing values were replaced with the mean (Hedderley and Wakeling, 1995).

**Study 2. Difference testing**

Data obtained from triangular tests were analysed by comparison with tabulated values (O’Mahony, 1986).

**Results and discussion**

**Preference testing**

From the 300 people interviewed only 101 consumers (34 per cent) returned the questionnaire. As observed in Table I, hedonic scores given to cheese, smoked salmon and chips were statistically higher \((p < 0.05)\), while smoked herring, smoked sardine and smoked curd were the least preferred products.

Bartholomew and Osuala (1986) suggested that scores of six and above using a nine-point hedonic scale assigned by the consumer panel to meat products might be commercially acceptable. In the present study it can be observed that nine products in the ballot obtained a hedonic score over six so they might be successfully commercialized; however, lard, smoked sausages, smoked herring, smoked sardine and smoked curd did not, so special considerations should be taken by the manufacturers in order to improve their sensory quality or to modify consumers’ representations of them. Interviewed consumers did, generally, present a clear preference tendency toward non-smoked products against smoked ones particularly for cheese, sausages and chips.

Some authors observed that there was no doubt that smoked products were preferred over the same products which have received no smoke processing (Baird et al., 1988; Sink, 1979). The variations among these results may be due to the different habit of consuming smoked foods of our assessors and the consumers they used in their tests as suggested by Gormley (1992).

Taguchi’s statistics (SNR) can be used to obtain ANOVA complementary information. His index takes into account the variability of the individual values and gives a measure of the robustness of the data (Gacula, 1993). It can be seen (Table I) the way this index decreases with acceptability scores, that is to say that, the most preferred samples are, at the same time, those having most robust data. His detail could be of extreme importance in the case of non-significantly different samples, but showing different SNR values, as for example lard and smoked sausages. In this case, lard preference data show higher robustness than smoked sausages and consequently its acceptance should be considered higher too.

**Internal preference mapping**

The results from MDPREF show that the first two preference dimensions accounted for 79.4 per cent of the variation in the preference data (Figure 1).

Examination of the plot of each consumer’s preference scores revealed that there is a clearly defined zone and direction in which people prefer the samples. Consumer position shows the directions of increasing liking for the different smoked products. This vector

<table>
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<th>Source</th>
<th>DF</th>
<th>CME</th>
<th>F</th>
<th>P</th>
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<td>Error</td>
<td>1,300</td>
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</table>

**Notes:**


b. Fisher’s LSD \((p < 0.05)\)
model assumes a linear model such that preference is greatest at the end of the subject vector.

People tend to cluster around the first preference dimension (74.6 per cent of the variation), thus it can be said that there exists an overall agreement about their preferences for the products appearing in the ballot. This plot is particularly good, as all the consumers prefer the samples on the left hand side of dimension 1, with cheese being the most acceptable overall.

It should be noted that foods located near one another are preferred in a similar way by consumers. Smoked herring and smoked sardine are located near to each other, which may indicate that consumers see those products as being very similar, distinguishing them from smoked salmon. It may be due to the luxurious concept of the latter against the other two (Henrik et al., 1995).

Based on the relative positions of the foods in the space, it was concluded that raw products and their smoked varieties do not display similar spatial configurations, except for smoked and non-smoked sausages. Less preferred items (smoked curd, smoked sardine, smoked herring, smoked sausages, lard) have positive coefficients for the first dimension, while those with higher preference scores (cheese, smoked salmon, chips) appear in the negative side of the X axis.

These results confirm the acceptability previously found by means of ANOVA, but revealed that consumers have very similar acceptability criteria.

**Study 2. Difference testing**

Cheese was the least confused product among the four sets presented to the panelists (43 per cent of wrong answers). It may be due to the familiarity and habit of cheese consumption that the consumer panel had. On the other hand, the higher rate of wrong answers in these tests was observed for the pair chips-smoked chips, where 61.4 per cent of the tests were failed. Salmon pâté and sausages obtained similar results, 60 per cent of the consumers were unable to distinguish amongst smoked and non-smoked varieties.

Statistical testing indicates that chips, salmon pâté and sausages, smoked and non-smoked, were not significantly distinguished ($p < 0.05$). The difference between the samples was in no case established, and clearly defined as due to a smoking treatment.

**Conclusions**

It seems to be obvious, at least studying this kind of product, that people’s concept (recalled preference) of smoked food is not primarily based on its sensory characteristics, because no differences were noticed in several commercial smoked products. Triangular test results hardly accounted for differences due to a smoke treatment; however, survey data revealed different preference scores depending on the items being smoked or not. This fact indicates that other unidentified factors must be defining consumer representations of smoked items, without a correspondence with its real organoleptic properties.

**References**


Smith, S.M. (1990), PC-MDS Multidimensional Statistic Package, version 5.1, Institute of Business MGT, Brigham Young University, Provo, UT, USA.

