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The effects of the smoking materials used in the sensory characterisation of the Palmero (PDO) cheeses

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SUMMARY – Palmero cheese is an uncooked pressed cheese, of "Protected Denomination of Origin" made with raw milk. The sensory properties of this product are influenced by the origin of the milk from a local breed as well as climatic, geographic and cheese-making practices. Smoking was a traditional way of preserving the cheese, but now the main objective of this process is to give it certain organoleptic characteristics. The aim of this study was to reveal if the material used for smoking affects sensory properties while avoiding consideration of all other effects. Experimental cheese samples were smoked with almond shells (*Prunus dulcis*), segmented cactus (*Opuntia ficus indica*), and needles and wood of Canary Pine (*Pinus canariensis*). A group of experts, according to Berodier *et al.* (1997) and Lavanchy *et al.* (1994) made the sensory analysis. The Principal Components Analysis showed a good distinction in the product using the different materials.

Key words: Sensory profile, smoke materials, goat's cheeses, traditional cheeses, quality products.

RESUME – "Les effets du matériel de fumage sur la caractérisation sensorielle des fromages Palmero (AOP)". Le fromage de la Palma ("Palmero") est un fromage à Appellation d'Origine, à pâte pressée, élaboré au lait cru de chèvre. Les caractéristiques sensorielles de ce produit sont influencées autant par la race productrice du lait que par les aspects climatiques, géographiques et technologiques. Le fumé, procédé traditionnel de conservation du fromage, est aujourd'hui utilisé pour conférer certaines caractéristiques organoleptiques. L'objectif principal de cette étude est de vérifier si le matériel utilisé pour fumer endommage les propriétés sensorielles en supprimant les autres effets. Les échantillons de fromages expérimentaux ont été fumés à la coque d'amande (*Prunus dulcis*), au cactus (*Opuntia ficus indica*), aux acicules et au bois de pin (*Pinus canariensis*). En se référant aux travaux de Berodier *et al.* (1997) et à Lavanchy *et al.* (1994), un comité d'experts a réalisé les analyses sensorielles. L'analyse des principaux composants montre une bonne distinction entre les fromages sur lesquels on a essayé différents matériels de fumage.

Mots-clés : Profil sensoriel, matériels de fumage, fromages de chèvre, fromages traditionnels, produits de qualité.

Introduction

Smoking is one of the oldest ways to preserve food, but modern techniques of the food industry have relegated these old preservation techniques to a second place. Nowadays, the main objective of the smoking process is to give to the food certain characteristics of colour, odour and flavour (Möhler, 1980). In La Palma Island (Canary Islands, Spain) the smoking of the cheeses is a traditional way to preserve them, at least since the XV century (País País, 1996) when the Archipelago joined the Spanish Crown.

There are many singularities that allowed these cheeses to be brought under a "Protected Denomination of Origin" (PDO) established in some countries including Spain to define and protect high quality traditional products against imitations. One particular characteristic arises in the use of raw milk from a local breed: the Palmera goat breed (Fresno and Fresno, 1999). Another is the animal feeding with indigenous forage plants like "tagasaste" [*Chamaecytisus proliferus* (L. fil) Link ssp. *palmensis* (Christ) Kunkel] and the "tedera" (*Bituminaria bituminosa*). The elaboration of the cheeses makes use of dried goat rennet and follows traditional customs that define the product (Darmanin *et al.*, 1992). The manufacture of these cheeses is described in the PDO regulations. The smoking

process uses four different materials, also typical from the island: shell of the almond (*Prunus dulcis*), segmented prickly pear cactus (*Opuntia ficus indica*), pine needles and wood of canary pine (*Pinus canariensis*), that generate four distinct categories of smoked cheese. This process takes place using a metallic drum (used by 81% of the cheese producers), also following traditional methods. The smoking time varied between 10 and 15 minutes, and the distance between the cheese and the fire was 50-80 cm (Fresno *et al.*, 2002).

Actually, the cheese makers of this island are making big efforts to adapt their workshops to the new technologies, while trying to conserve all the specific characteristics of their cheeses (Fresno *et al.*, 1998). Various studies about these cheeses are in progress and this paper is included in a research project CAL00-054-C3-1 "Study of the smoking process of Palmero cheeses (DPO)". This particular study shows only the effects of the smoking material on sensory properties while avoiding all other considerations. Sensory quality is one of the most important attributes for the successful marketing of smoked cheeses (Bárcenas *et al.*, 1998, 2001), and the total characterisation of this kind of cheese is needed to protect these varieties from fraud (Bárcenas *et al.*, 1999).

Material and methods

All the experimental cheese samples (16 cheeses, 4 for testing each smoking material) were made and smoked in the Canary Institute of Agrarian Research, ICIA, following the instructions given by the Protected Denomination of Origin Regulating Council of Palmero Cheese. The process used raw milk from the Palmera goat and the animals were fed with traditional forage ("tagasaste" and "tedera"). Overall the traditional process of manufacture was observed. For the smoking process the typical metallic drum was used, following the normal method. The period of smoking was representative of the common average practice in La Palma Island. Moreover, these methods were optimised in previous works (Fresno *et al.*, 2002). The four authorised smoking materials were used: shell of almond, pine, needle of pine and segmented cacti. These various smoking techniques were the only differences among the cheeses.

Assessments were performed during a single daylong session, where four cheese varieties were evaluated. Samples, coded with 3-digit random codes (Meilgaard *et al.*, 1991), were always presented in the same order to each assessor (Suriyaphan *et al.*, 2001) to avoid the effect of the presentation order (Muir and Hunter, 1991). The cheeses were served without any identification of origin or smoking material used. The methodology employed has been previously described, odour and flavour attributes according to Berodier *et al.* (1997), and texture following the guidelines published by Lavanchy *et al.* (1994). A group of six trained cheese tasters with more than 10 years of experience constituted the sensory panel and described the cheeses. This panel works in collaboration with the PDO Palmero Cheese Regulating Council.

Cheese samples were presented as 1.5 cm thick × 1.5 cm wide × 5-8 cm long portions, with the rinds cut away. The size and shape of all pieces were the same (Cardello and Segars, 1989). Two portions per sample were served, one to evaluate texture and the other one to evaluate odour and flavour (Lavanchy *et al.*, 1994). Serving temperature was $20 \pm 1^\circ\text{C}$ (Engel *et al.*, 2000). Unsalted crackers, Granny-Smith apples and water with low levels of salt were served to remove any aftertaste. The sensorial analysis was developed in a special room of the ICIA, following the instructions given by the UNE 87-004 norm (AENOR, 1979). The results of the assessments for sensory attributes of the cheeses were evaluated by one-way analysis of variance (ANOVA), and the significance of differences between the samples was calculated using Fisher's test for the multiple comparison of means ($P < 0.05$). Moreover, we used the Principal Component Analysis (PCA). The statistical processing was performed using the SYSTAT 10.0 package from SPSS Inc., the Excel software from Microsoft, and the Canoco package from Microcomputer Power (Braak and Smilaver, 1998).

Results and discussion

The texture evaluation is shown in Fig. 1. In this case, there are significant differences especially in the elasticity ($F = 12.5$) and in the friability ($F = 4.4$), characteristics that allows for distinction. Moreover, the ANOVA analysis showed that there are significant differences in the moisture ($F = 21.4$), adhesivity ($F = 5.7$) and solubility ($F = 7.7$). The texture profile for the four materials is shown in Fig. 2, where the differentiation between them can be clearly seen.

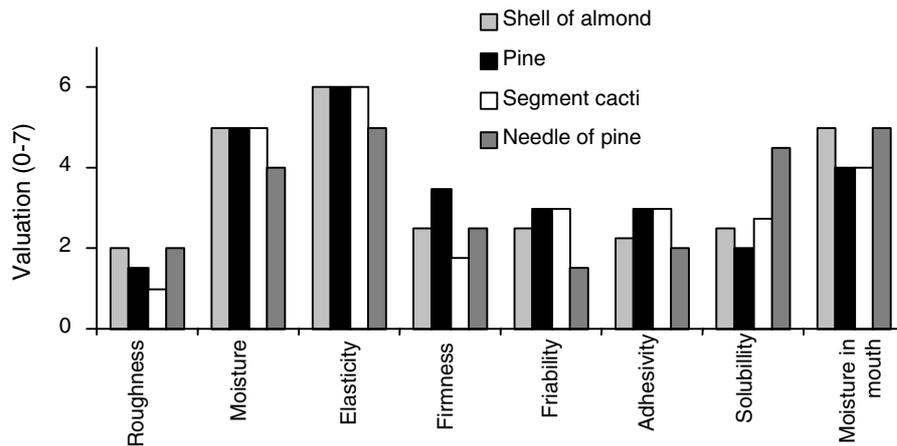


Fig. 1. Texture evaluation.

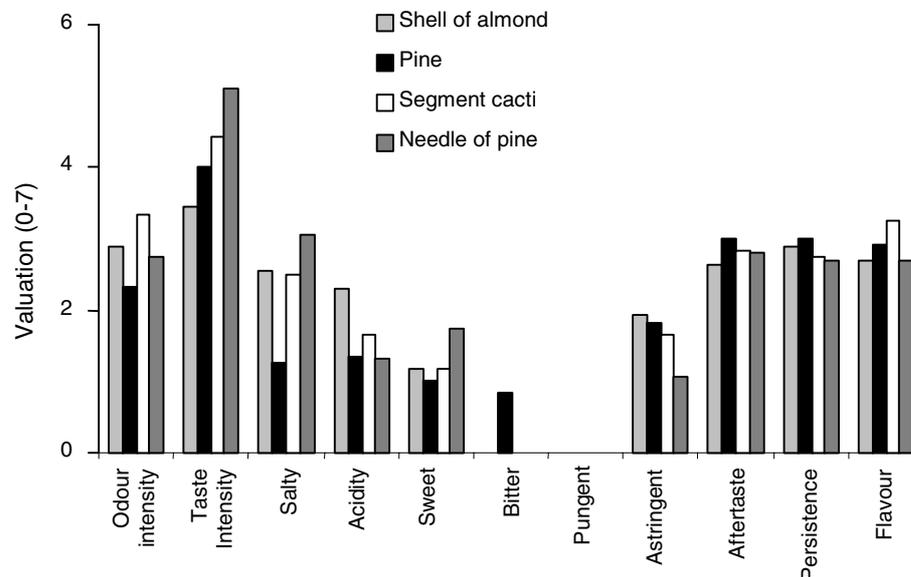


Fig. 2. Flavour and taste evaluation.

The flavour and taste evaluation also shows significant differences especially in the elemental taste bitter ($F = 12.0$) and in the aftertaste ($F = 9.3$). Figure 2 shows these results.

The PCA of the sensory characteristics of texture using the experimental cheeses is shown in Fig. 3. There is a good distinction between cheeses smoked with different materials regarding the texture. All cheeses smoked with pine needles appear in the right-central zone of the diagram. The cheeses smoked with pine are located in the lower left zone. The cheeses smoked with almond shell are located in the central zone, and the cheeses smoked with segmented cacti are located in the upper left zone of the diagram, except the one marked "sc1". All the texture variables have an important role for cheeses distinction depending on the smoking material used especially the firmness.

The PCA of the sensory characteristics of odour and flavour of all experimental cheeses is shown in Fig. 4. A good distinction between cheeses smoked with different materials can be seen. All cheeses smoked with pine needles are located in the right lower zone of the diagram. The cheeses smoked with almond shells are located in the left lower zone. The cheeses smoked with segmented

cacti are located in the upper right zone, except the one marked with "sc1". The cheeses smoked with pine are located in the upper left zone, except the one marked "pi4". As it can be seen, all the sensorial variables are quite important for the overall distribution. In this sense it is clear the importance of developing an exhaustive sensorial analysis to ensure a correct characterisation of the cheese.

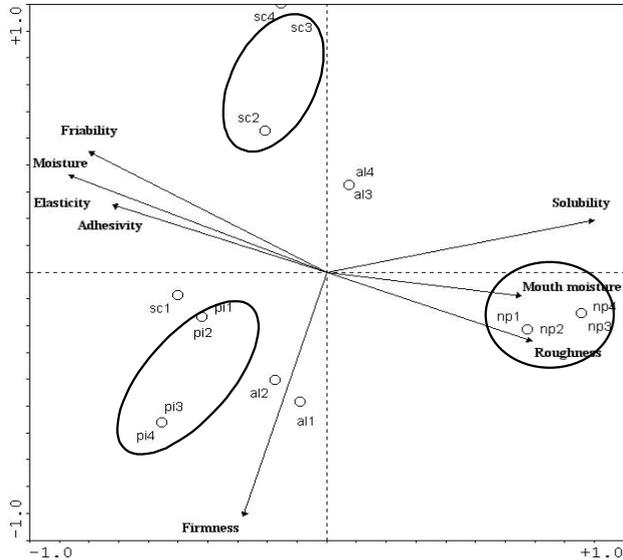


Fig. 3. PCA of the sensory characteristics of texture. al: shell of almond; pi: pine; sc: segment cacti; np: needle of pine.

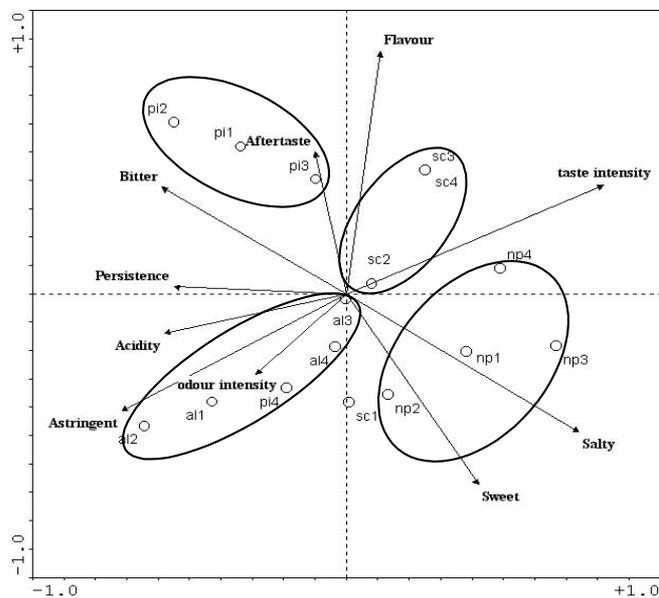


Fig. 4. PCA of the sensory characteristics of odour and flavour. al: shell of almond; pi: pine; sc: segment cacti; np: needle of pine.

Conclusions

The characterisation and optimisation of the smoking process led to the finding of specific

elements of this product that will aid identification and prevention of falsifications and fraudulent imitation. The comparison of the effect of smoking material as a technical factor in the cheese production of Palmero PDO cheeses revealed significant sensory differences. Sensory analysis is a very useful and effective tool in differentiating and defining these cheeses.

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