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SENSORY CHARACTERIZATION OF SPANISH AND FRENCH DRY-CURED HAMS IN RELATION TO SPANISH TYPICALITY PROFILES

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Introduction

Dry-curing of hams is a common practice in the South European countries. It is one of the most important ways of processing pork in Spain and Italy. The dry-curing process was originally used as a preservation method. However, this process has been improved to develop a more desirable flavour and a softer texture producing the characteristic Mediterranean Hams (González et al. 2000). In the Mediterranean regions of Europe, the term "cured" is used when they produce hams utilizing a long period of aging (usually between 6 to 12 months) where enzymatic action occurs and a distinctive flavour is developed. However, in the northern region, the term "cured" is limited to products that receive nitrite during processing (Flores 1997).

Spanish, Italian and French hams are representative of high-quality dry-cured hams of the Mediterranean areas. That is why, in 1992, the European Union created systems known as PDO (Protected Designation of Origin), PGI (Protected Geographical Indication) and TSG (Traditional Speciality Guaranteed) to promote and protect them. So among Spanish, Italian and French hams it is possible to find these brands which play a key role by leading consumer choice in a positive feeling of reassurance. Brands give a guarantee cue to consumers.

The quality of the dry-cured ham depends on multiple factors, such as animal breeding, animal age, feeding, environmental conditions previous to slaughtering (antemortem factors) and meat handling and ham manufacturing (postmortem factors). However, the most important factors that influence the sensory properties of hams are the raw materials and the ripening conditions (Toldrá et al. 1997; Cilla et al. 2005). In France, the production of dry-cured hams is lower than in Italy or Spain, but the consumption of this product is continuously increasing (Buscailhon et al. 1994). Dry-cured hams are made in France from white pigs (around 110-120 kg live weight). The curing mixture is made exclusively of dry salt, nitrite and/or nitrate and spices. They are not smoked. Generally, the total processing duration does not exceed nine months. The Spanish Iberian hams are produced from the Iberian breed from the Southwestern region of Spain fed in pastures with acorns, weighing 85-90 kg (the age of slaughter is 10-12 months). The product achieves a high degree of marbling, soft texture and typical dry cured-ham flavour. The common dry-cured hams are produced from crossbreed white pigs with a low marbling score, firmer texture and a typical dry-cured-ham flavour,

which depends on the length of ripening (Toldrá et al. 1997). In Spain the traditional dry-curing process consists of a mixture of curing adjuncts that are applied to hams without any added water or spices. In this process, the curing mixture penetrates by diffusion aided by the original moisture of the meat. Common ham is ripened for 9 to 15 months while the Iberian ham may be held for 18 to 24 months. The complexity and combination of biochemical reactions occurring during the ripening stage determine the sensory characteristics of the hams (Verplaetse 1994; Flores 1997).

Objectives

The objectives of this work were to find typicality parameters that allow to characterize and group objectively French (white) and Spanish (Iberian and white) hams, as well as to find relations among sensory traits and factors such as breed, maturation, origin and quality label which define each group of hams in order to establish differences.

Methodology

Twenty-one Spanish hams (8 Iberian hams and 13 white hams) and 20 French hams were processed by local manufacturers using the traditional method of each geographical origin (Flores et al., 1993; Sabio et al. 1998). Table 1 shows the codes of the samples, their geographical origin, breed, maturation time and quality label according to Regulations (EEC) nº 2081/92 and 2082/92 (DOCE, 1992). Hams were deboned and portions were taken in a transversal cut at 6 cm below the femur head which included Biceps femoris (BF), Semimembranosus (SM) and Semitendinosus (ST) muscles. The obtained portions of about 10 cm thick were stored at 4 ± 2ºC in vacuum until they were required for sensory analysis and then cut in slices (1.5 mm thick) using a slicing machine. Typicality traits were defined by a group of Spanish experts on that field (scientist and producers) with a deep knowledge of the different dry-cured hams used in this work. Typicality attributes deal with several attributes of the given products which explained the ideal profile of traditional hams in order to fit with consumer expectations. This attributes were: marbling, aroma, hardness, softness, flavour, acorn flavour, saltiness and sheen. These parameters were included in the sensory test for trained panel and they were explained according to expert definitions. Dry-cured ham samples were individually assessed by a trained panel of 13 Spanish members (Universidad de Zaragoza). To acquaint panellists with product attributes and intensities, ten 1 hour training sessions took place over a 4 week period prior to sample testing. During this phase, panellists were presented dry-cured hams from a variety of manufacturers corresponding to maximum and minimum intensities that might be found for each attribute (1, very low, to 9, very high). The panel sessions were held at mid-morning, about 3 hours after breakfast. Slices were served on plates. A profile of 24 sensory attributes of dry-cured ham (croutage, colour of BF, SM, colour homogeneity, subcutaneous fat, fat colour, marbling, aroma intensity, rancidity, nut aroma, mould aroma, toughness, softness, crumbliness, fibrousness, pastiness, adhesiveness, ham flavour, saltiness, rancidity, nut flavour, sweet taste and sheen), as well as overall acceptability, was assessed. About 50 ml of water at room temperature and 20 g of unsalted bread were provided between successive hams. All sessions were done at 22ºC in a sensory panel room equipped with white fluorescent

lighting (Philips TLD 86, 5600 ºK, 800 lux). Four hams from different groups (Spanish and French) were successively evaluated in each session. The sample order was randomised.

Statistical analysis: The statistical study of the differences among the classes of samples (French vs. Iberian and Spanish white hams) was carried out by multivariate analyses by means of SPSS version 11.5 (2005). In order to verify typicality attributes as good criteria for classification of French vs. Iberian and Spanish white hams, a cluster analysis was carried out. Principal Components Analysis (PCA) was applied to check the results of the supervised procedure and to find the relations among sensory traits and sampling factors (breed, origin, country, maturation and quality label) which could explain the differences among the groups.

Results & Discussion

Sensory evaluation

Figure 1 is a plot of the PCA of sensory traits form trained panel loading for the first two partial least squares components. The first component was able to predict 37.38% of the total variation while the second component contributed a further 12.12%; thus an accumulative 49.5% of total variation was explained by the first two principal components. The first component might be interpreted as the main factors contributing to acceptability, since the factorial coefficients of acceptability and variables related to colour, flavour, aroma, odour, maturing time, origin and quality label showed the highest positive coefficients, whereas saltiness, pastiness and adhesiveness had negative. On component 2 positive loading had pastiness, adhesiveness, saltiness, fibrousness and hardness, whereas crumbliness and softness had negative coefficients. According to the plot of analyzed samples (Figure 2), the first component was able to discriminate most sharply samples in three different groups (French, Spanish white and Iberian hams). Iberian hams were located with positive loading on the first component 1 indicating the highest acceptance of this group according the Spanish trained panel. French were mainly located with negative loading on component 2 (less acceptance) probably due to shorter time of maturing and Spanish white hams located in a mid position. However, some samples were not classified as expected. S05, S17, S20 were located with negative loading on component 2. S05, S17, S20 were from Spanish white hams. Their location might be explained due to the detection of atypical sensory attributes. F13, F14 and F17 were classified into the Spanish white hams group probably due to similar sensory profile of Bayonne hams to this group.

PCA results were highly representative of the factors interactions. According to Pearson correlations, acceptability decreased with increasing pastiness (-0.390), adhesiveness (-0.309) and saltiness (-0.366) which were significant at $p<0.05$ level. Similar results were found by Cilla et al. (2005). About sampling factors it is important to consider that breed, geographical origin, label and maturation time are representative of high-quality dry-cured hams due to the influence on acceptability, so these factors are good guarantees of quality.

Typicality parameters

Figure 3 shows the results from Cluster analysis. The samples were properly clustered according to typicality traits into expected groups (French, Spanish white and Iberian hams). Exceptions were F13 and F14 which were included with Spanish white hams. The results confirmed typicality attributes defined by experts as good criteria for classification.

Conclusions

Typicality parameters defined by experts constituted a good method for dry-cured ham classification depending on quality expectation. PCA results confirmed these grouping method, as well as to establish differences among groups, relations among sensory traits and sampling factors (breed, geographical origin and maturing time) on the Spanish trained panel's acceptability. Iberian hams were highly scored while French dry-cured hams registered lower scores. Spanish white hams and Bayonne hams had very similar sensory profile and maintained a mid position between Iberian and French hams. Among sensory traits, pastiness, adhesiveness and saltiness influenced negatively on acceptability whereas, aroma, flavour, odour and colour positively, indicating a suitable maturation time. Factors such as breed, geographical origin, and label constituted a guarantee for quality.

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Tables and Figures

Table 1. Geographical origin, kind of breed, maturing time and label of the coded samples

Code	Geographical origin (Region, Country)	Breed	Maturing time (months)	Label
S01	Teruel, Spain	NIB(1)	12-18	PDO(2) Teruel
S02	Teruel, Spain	NIB	12-18	PDO Teruel
S03	Teruel, Spain	NIB	≥18	PDO Teruel
S04	Teruel, Spain	NIB	8-11	-
S05	Miscellaneous, Spain	NIB	8-11	TSG
S06	Teruel, Spain	NIB	12-18	-
S07	Miscellaneous, Spain	NIB	8-11	-
S08	Miscellaneous, Spain	NIB	8-11	-
S09	Miscellaneous, Spain	NIB	12-18	-
I10	Southwest Spain	Iberian	≥18	PDO Guijuelo
I11	Southwest Spain	Iberian	≥18	PDO Huelva
I12	Southwest Spain	Iberian	≥18	PDO Los Pedroches
I13	Southwest Spain	Iberian	≥18	-
I14	Southwest Spain	Iberian	≥18	-
I15	Southwest Spain	Iberian	≥18	-
S16	Teruel, Spain	NIB	12-18	PDO Teruel
S17	Teruel, Spain	NIB	12-18	-
I18	Southwest Spain	Iberian	≥18	-
I19	Southwest Spain	Iberian	≥18	PDO Extremadura
S20	Miscellaneous, Spain	NIB	8-11	-
S21	Miscellaneous, Spain	NIB	12-18	TSG(3)
F01	Auvergne, France	NIB	8-11	TSG
F02	Auvergne, France	NIB	8-11	-
F03	Auvergne, France	NIB	≥7	-
F04	Auvergne, France	NIB	≥7	-
F05	Auvergne, France	NIB	≥7	-
F06	Auvergne, France	NIB	12-18	-
F07	Auvergne, France	NIB	8-11	-
F08	Auvergne, France	NIB	8-11	-
F09	Aveyron, France	NIB	8-11	-
F10	Lacaune, France	NIB	8-11	-
F11	Lacaune, France	NIB	≥7	-
F12	Lacaune, France	NIB	8-11	TSG
F13	Bayonne, France	NIB	12-18	PDO Bayonne
F14	Bayonne, France	NIB	12-18	PDO Bayonne
F15	Auvergne, France	NIB	8-11	-
F16	Lacaune, France	NIB	8-11	-
F17	Bayonne, France	NIB	8-11	PDO Bayonne
F18	Miscellaneous, France	NIB	8-11	-
F19	Miscellaneous, France	NIB	≥7	-
F20	Miscellaneous, France	NIB	8-11	-

(1) NIB: Non Iberian Breed. Common European breeds: Large white, Landrace, Duroc and their crosses

(2) PDO: Protected Designation of Origin
(3) TSG: Traditional Speciality Guaranteed

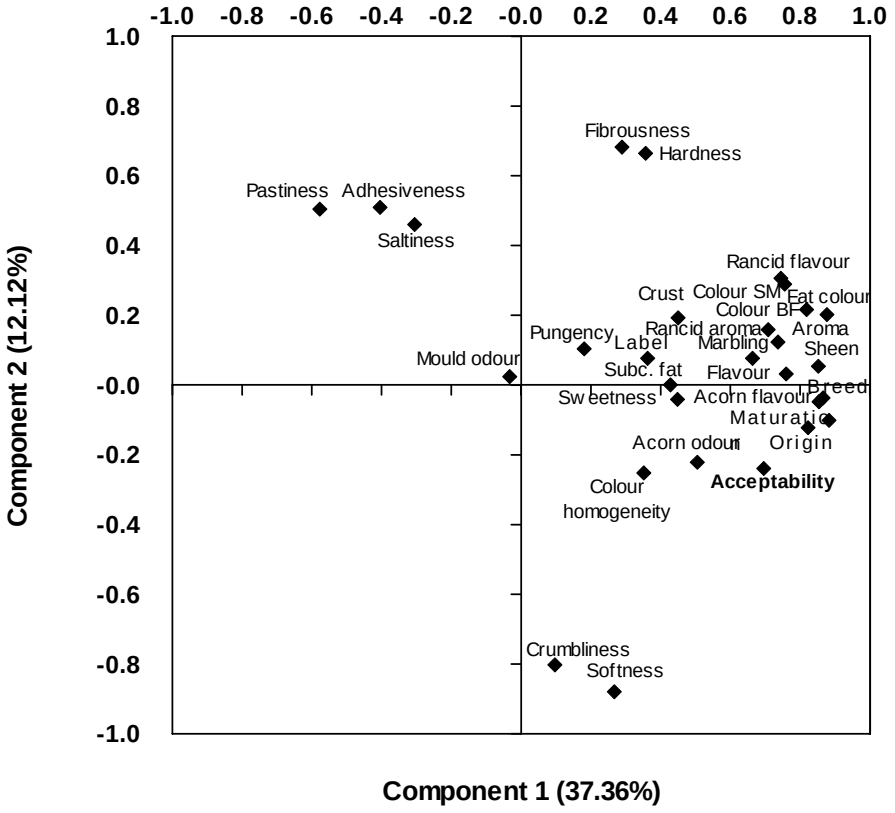

Fig. 1. Plot of the loadings obtained for the parameters included in the principal components analysis, (origin, breed, label, maturing time, sensory traits and overall acceptability).

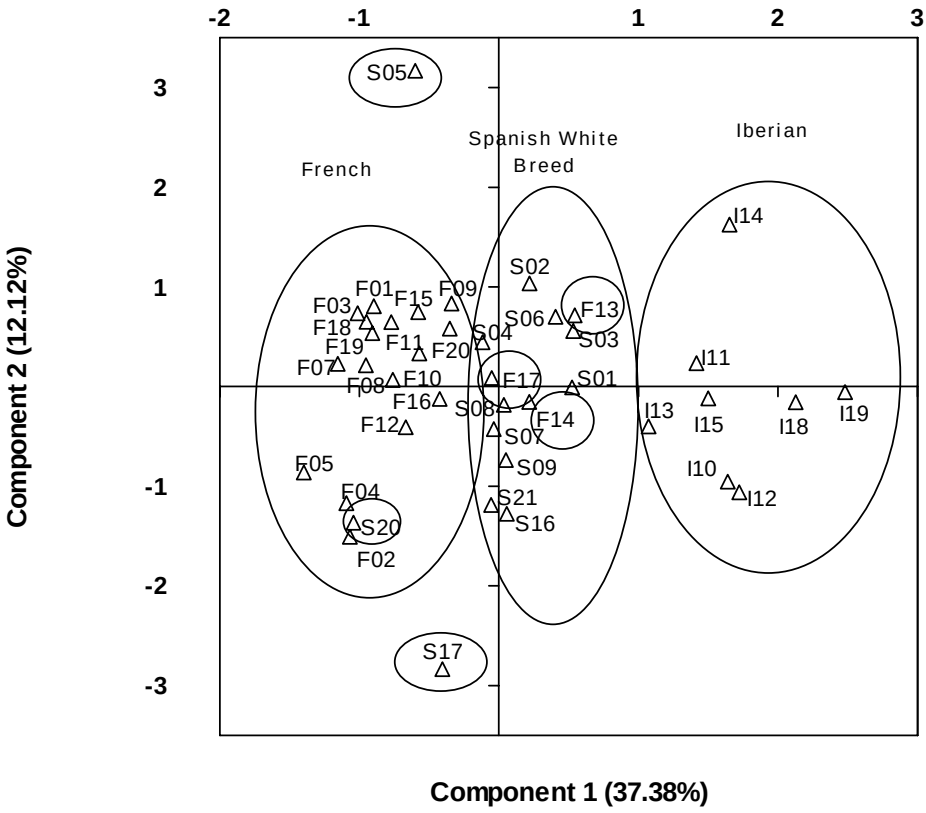

Fig. 2. Plot of analyzed samples (French, Spanish White and Iberian hams) in the principal component analysis test.

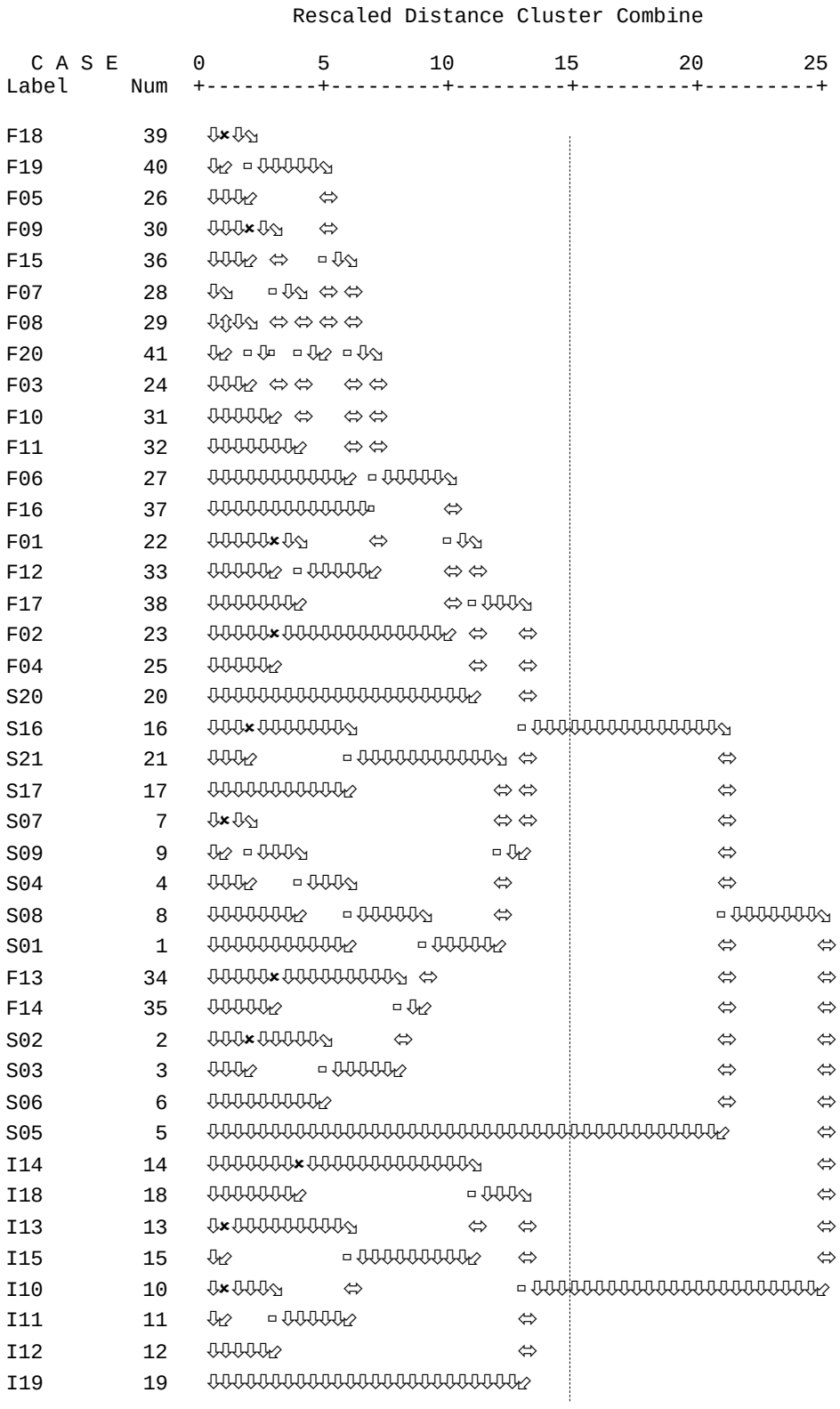

Fig. 3. Clustered display of data from typicality traits. Different cases were grouped at 13 points of rescaled distance.