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Volatile compounds and sensorial traits of "Toscano" dry-cured ham

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Abstract. The aims of this study were to evaluate the effect of seasoning time on aromatic profiles and to describe the sensorial profile of "Toscano" dry-cured ham. At this aim ten hams, cured according to the rule of "Toscano" PDO label, were sampled at the begin of seasoning and at 1, 3, 6 and 12 months. The samples of muscular tissue were submitted to volatile compounds analysis by SPME-GC/MS. At the end of seasoning a sensorial analysis of hams was carried out by a trained panellist group. As regard volatile analysis, about 80 compounds were identified belonging to: aldehydes, organic acids, ketones, esters, alcohols and furans. Aldehydes represent the most important chemical family in "Toscano" ham; they showed a significant increase only in the first 6 months of seasoning. The second quantitatively important chemical family in "Toscano" ham was that of the organic acids that increased along the whole curing time. Ketones dramatically decreased at 12 months of seasoning while esters showed a more constant trend. Significant correlations were found among sensorial traits and aldehydes compounds.

Keywords. Volatile analysis – Sensorial profile – Dry-cured ham – Seasoning.

Les composés volatils et les caractéristiques sensorielles du jambon sec "Toscano"

Résumé. *Les objectifs de cette étude étaient d'évaluer l'effet du temps de mûrissage sur les profils aromatiques et de décrire le profil sensoriel du jambon sec "Toscano". Dix jambons mûris selon la règle du label AOP "Toscano", ont été échantillonnés au début du mûrissage et à 1, 3, 6 et 12 mois. Les échantillons de tissu musculaire ont été soumis à l'analyse des composés volatils par SPME-GC/MS. À la fin du mûrissage l'analyse sensorielle des jambons a été réalisée par un groupe d'experts qualifiés. Pour ce qui concerne l'analyse des composés volatils, environ 80 composés ont été identifiés appartenant à: aldéhydes, acides organiques, cétones, esters, alcools et furanes. Les aldéhydes représentent la famille la plus importante dans le jambon "Toscano", et ils ont montré une augmentation significative seulement dans les 6 premiers mois de mûrissage. La seconde famille de substances chimiques la plus importante quantitativement dans le jambon "Toscano" a été celle des acides organiques qui ont augmenté pendant tout le temps de mûrissage. Les cétones ont diminué considérablement à 12 mois de maturation tandis que les esters ont montré une tendance plus constante. Des corrélations significatives ont été trouvées parmi les caractères sensoriels et les composés aldéhydes.*

Mots-clés. *Analyse de composés volatils – Profil sensoriel – Jambon sec – Mûrissage.*

I – Introduction

Several studies have been dealing with the flavour of ham of Mediterranean area (Dirinck *et al*., 1997), either on the relationships between compositional traits and sensory qualities of French and Italian dry-cured ham or on the volatile profile of Iberian hams and on its evolution with ripening, with the identification of the compounds primarily responsible for the typical aromatic characteristics. Also, Italian Parma and San Daniele hams have been characterized for their aromatic composition (Careri *et al*., 1993, Bolzoni *et al*., 1996; Gaspardo *et al*., 2008).

Conversely, the information on the ""Toscano"" dry-cured ham are, at present, limited to physical-chemical traits as affected by genetic type and rearing system (Franci *et al*., 1997; Pugliese *et al*., 2005; Pugliese *et al*., 2010), while information on its volatile composition are still lacking. There are also few details on its sensory properties. So the aim of this trial is to investigated the evolution of volatile compounds profile of "Toscano" dry-cured ham during 12 months ripening by SPME-GC-MS and, at the same time, to describe its sensorial profile at the end of the 12 months of seasoning.

II – Materials and methods

Ten hams were seasoned for 12 months according to the "Toscano" PDO Consortium ripening protocol and *Biceps Femoris* muscle was sampled immediately after trimming and after 1, 3, 6, 12 months of ripening. The volatile compound profile was obtained by SPME–GC-MS technique. An Agilent 7890 GC-Chromatograph equipped with a 5975A MSD with EI ionization was used for analysis. Volatile compounds were identified by matching EI mass spectra against NIST 05 or Wiley 07 spectral library and Kovats indices. As regard sensorial analysis samples of cured ham were assessed by a trained panel of 10 members using a descriptive analysis method. A 100 mm unstructured scale was used. Three-four hams were evaluated simultaneously in each evaluation session and the samples order was randomised. Data were subjected to analysis of variance using, as fixed effects, "ham" (10 levels) and "time of ripening" (5 levels) for evolution of aromatic profile or "panellist" (10 levels) for sensorial data. Significant differences were tested after Student's t test. Principal Component Analysis (PCA) was applied to evaluate the relationships among variables.

III – Results

Over 60 compounds belonging to esters, aldehydes, organic acids, ketones and alcohols were identified but for lack of space the means of each aromatic compounds were not tabulated while their evolution is shown in Fig. 1.

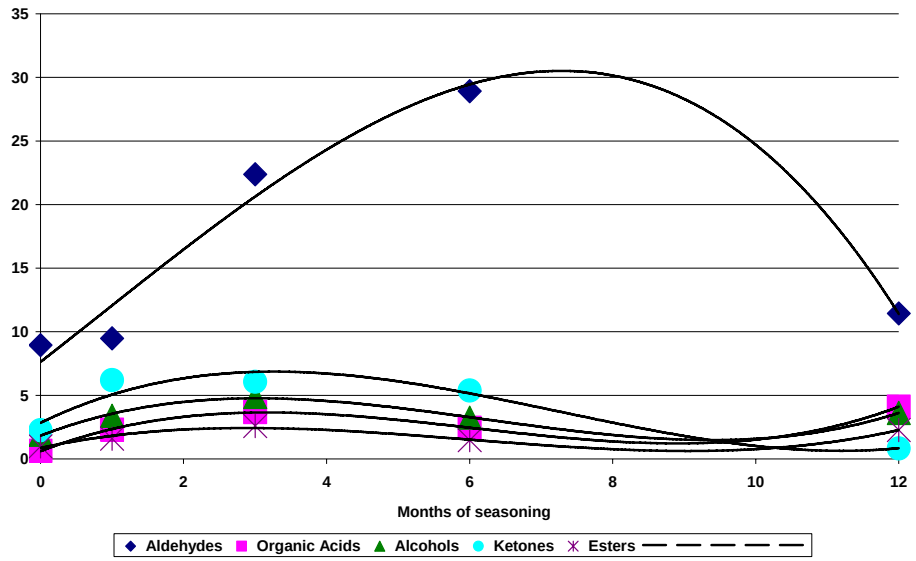

Fig. 1. Evolution of the main chemical families according to seasoning time.

Aldehydes were the most represented compounds in "Toscano" ham, similarly to what reported on lean tissue of Iberian cured ham (Ruiz *et al*., 1999). The aldehydes and ketones groups reached their greatest relative concentration at 6 and 1 month of ripening, respectively, and then decreased significantly, probably due to further reactions with other compounds. Alcohols, organic acids and esters concentration increased until the third month of ripening, and remained rather constant until 12 months. The described trend of the chemical families was strictly linked to the drying/ripening conditions when most of the biochemical changes become relevant. In the ripening stages a temperature of 16-18℃ is adequate for the activity of the lypolitic and proteolytic enzymes, which progressively decrease thereafter, probably due to the contemporary water activity decrease along the process.

Table 1 shows the means and standard deviations of the sensory traits. The variability of the traits was quite high, that means that “Toscano” dry-cured ham is characterized by a medium-low degree of homogeneity. This can be considered a problem from commercial point of view but, on the other hand, it is a guarantee of a really traditional production process.

Table 1. Sensorial analysis of "Toscano" ham

Parameter	Means (mm)	Significance of "ham effect"	Standard deviation
Yellowness	33.10	<.0001	21.34
Pinkness	40.49	0.0056	18.08
Oiliness	41.90	0.0106	18.70
Firmness of fat	42.62	0.6815	17.76
Internal fat knob	40.39	0.0050	15.92
Quantity of external fat	41.33	0.1583	16.94
Redness	47.30	0.0005	16.26
Uniformity of color	42.83	0.0024	15.40
Marbling	44.07	<.0001	15.60
Firmness of lean	48.00	0.0015	15.72
Odor intensity	53.83	0.4942	16.67
Saltiness	35.48	0.1439	20.74
After taste	53.06	0.3729	15.84
Rancidity	7.25	0.8018	12.05
Hardness	30.69	0.4049	17.86
Juiciness	50.42	0.0004	22.63
Persistence	54.80	0.3566	19.99
Overall acceptability	56.79	0.0634	17.55

The variability of the data is high only for what concerns the data of color and of fat (quantity and quality). For other parameters, related in particular to aroma and odor, the variability among hams was very small. This fact attests to the validity of the curing process that can provide homogeneous products in these respects. As regards PCA, two principal components were generated that accounted for 60% of the total variance (PC1 = 39% and PC2 = 21%). The score plot of the samples is shown in Fig. 2. For PCA only aldehydes compounds were used because they were the only compounds that showed significant correlations with sensorial traits. As it can see in the figure the sensorial traits link to taste are very poor related with aldehydes compounds. The only positive relationships were found with 13-octadecenal, benzeneacetaldeyde, benzaldeyde and nonanal that seems to be related to rancid aroma (García-González *et al*., 2008).

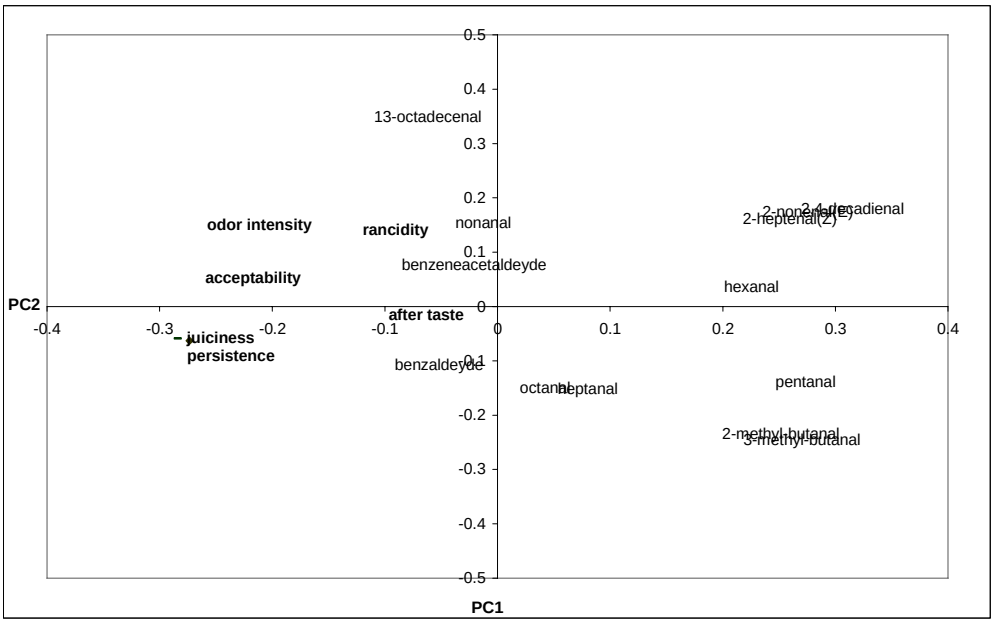

Fig. 2. Principal Component Analysis results.

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