PE8.04 Use of electronic nose to discriminate either the feeding background or preservation time of fat from Iberian pig cured hams 11.00

Ana Rey (1) anarey@vet.ucm.es, C Pugliese(2), F Sirtori (2), A Daza(2), C Lopez-Bote (1), O Franci(2)
(1)Dpto. Producción Animal, Facultad de Veterinaria, Universidad Complutense de Madrid, Spain
(2)Dpto. Producción Animal, ETSIA, Universidad Politécnica de Madrid, Spain
(3)Dipartimento di Scienze Zootechniche. Universitá degli studi di Firenze, Italy

Abstract **The use of the electronic nose (piezoelectric sensor) for the differentiation of dry-cured ham fat from Iberian pigs fed different feeding and the capacity of discrimination depending on the preservation time of the samples was checked.**

Twenty four hams from Iberian pigs fed different feeding were used. One group was from pigs fed under free-range conditions; a second group was from pigs fed in confinement with acorns and a third group from pigs fed a mixed diet. In parallel, cured-fat samples from each group of hams were cut and maintained at 4 °C for 0, 7, and 14 days. Piezoelectric sensors did not discriminated between those pigs fed free-range, acorns or feed in confinement. However, separation of the fat samples with different preservation times was properly achieved with this analysis, even thought a slight overlapping was observed. Consequently, the piezoelectric sensor seems not to be a good tool to discriminate the feeding background of cured hams from Iberian pigs, however this could be properly used to separate samples with different preservation time.

Index terms

Electronic nose, hams, Iberian pig, preservation time

I. INTRODUCTION

The use of the electronic nose in quality control has been widely extended during the last few years due to its easy and fast management when compared with other techniques based on gas chromatography (Hansen et al., 2005). In the Iberian dry-cured ham, flavour mainly depends on the feeding and the ripening time. Hence, the aroma is an important quality parameter that maybe used as a differentiation factor of the product. In the Iberian pig has been previously explored semiconductor multisensorial system based on tin oxide (Otero et al., 2003) and metal oxide semiconductor sensors (González-Martín et al., 2000) with enough sensitivity and reproducibility to obtain good results as a quality control method. However, there is not information of the use of the acoustic wave sensors (piezoelectric) in the control of the Iberian pig products. The correct differentiation of the end-product is of special interest in the Iberian pigs raised extensively because their reach a high price in the market. The traceability of fresh and cured fat of Cinta Senese pigs fed different feeding was previously evaluated using a quartz microbalance based (QMB) electronic nose as a piezoelectric sensor (D'Adorante et al., 2007). On the other hand, there is not information on the possible use of the electronic nose to discriminate between fat samples that have been preserved during different days. In the present work we study the use of a piezoelectric sensor for the differentiation of ham fat from Iberian pigs fed different feeding and the capacity of discrimination depending on the preservation time after cutting.

II. MATERIAL AND METHODS

Twenty four Iberian barrows (El Dehesón del Encinar, Junta de Comunidades de Castilla-La Mancha, Oropesa, Toledo, Spain) of approximately ten months with an average initial live weight of 100.1 kg (s.e.m.: 1.9 kg) were randomly distributed in 3 groups of 8 pigs each. One group was fed under free-range conditions with acorns and grass during 117 days. The other group was located in individual cages and fed in confinement during the same period (117 days) with acorns from Quercus ilex and Q. suber collected in a Mediterranean forest located in Oropesa (Toledo, Spain). A third group was fed a formulated diet. The average daily amount of acorns and feed given to pigs was 4.04 kg and 3.0 kg, respectively. Pigs were slaughtered at an average weight of 146.5 (s.e.m.: 3.7 kg). The right thigh of eighteen pigs (six per treatment) was obtained and processed in the traditional way for approximately 3 years to obtain a dry cured ham.

Samples of fat from cured ham were collected and performed using an electronic nose system based on Quartz Microbalance Sensors, coated by modified metallo-porphyrins and related compounds (Libra Nose-Technobiochip and University of Rome 'Top Vergata', Italy). Five grams of minced sample were placed into a jar and maintained at a constant temperature for ten minutes to allow a static headspace generation. Nitrogen was bubbled through the jar to carry the volatile organic compounds into the sensor chamber, where 7 sensors interacted with the aromatic compounds, resulting in a different frequency ΔF (Hz) between the measured signal and the initial based oscillation frequency (20 MHz). Changes in resistance were recorded by a computer that controlled the whole system. Sensors were cleaned between analyses of the different samples by nitrogen stream during 10 minutes.

To study the capacity of the electronic nose to discriminate according the preservation days after cutting, cured-fat samples from the Iberian hams were obtained and maintained at 4 °C for 0, 7, and 14 days. On these days, samples were taken and measurements with the electronic nose were carried out at the same conditions that those mentioned above.

Data were analysed by analysis of variance using the GLM procedure (SAS, V.9) to study the effects of type of feeding, temperature, date of analysis, time of self-preservation etc. The varimax rotation procedure contained in SAS was also used for Factor analysis.

III. RESULTS AND DISCUSSION

In fig. 1 is presented the factorial analysis (two principal components) for ham fat samples according to the dietary treatment. Piezoelectric sensors did not discriminate properly the feeding background. D'Adorante et al. (2007) using the same type of electronic nose found that sensors significantly discriminated fresh fat samples according to pig feeding, but these were not able to separate cured fat samples and this fact was attributed to the absorption of the spices during the seasoning period that affected on the aroma. However, in the present study dry-cured ham processing implicates only sodium chloride addition and a ripening time at different temperatures and relative humidity. On the other hand, Otero et al. (2003) using a different electronic nose was able to discriminate Iberian dry-cured hams according to the type of drying and Santos et al. (2004) classified properly products derived from Iberian swine according to the feeding and ripening time.

To study the possible effect of other sources of variability such as temperature and day of analysis an ANOVA was carried out (table 1). It was not detected any significant effect on the factors values. So, this statistical analysis further confirms that this type of sensor (piezoelectric) does not have enough sensibility to detect different flavours according to the feeding (fig. 1) in those samples in which salt is added and a maturation time needed.

The capacity of the sensor to separate the conservation time is presented in fig. 2. Separation of dry-cured fat samples with different preservation times after cutting was properly achieved with this analysis, even thought a slight overlapping was observed. Other studies assessed in raw samples to predict the quality of the end-product (Hansen et al., 2005, González-Martin et al., 2000) have been successful. However, these studies were carried out in raw samples. To our knowledge there is not information in the literature on processed products so these results could be an interesting contribution.

IV. CONCLUSIONS

The piezoelectric sensor seems not to be a good tool to discriminate the feeding background of Iberian pig cured hams; however this could be properly used to separate ham fat samples with different conservation time after cutting.

ACKNOWLEDGEMENTS

This experiment was supported by the integrated action Spain-Italy nº HI2007-0172.

REFERENCES

[1] D'Adorante, S., Pugliese, C., Parenti, S., Campodoni, G. & Crovetti, A. (2007). Italian Journal of Animal Science, 6 (1), 680-682.

[2] Hansen, T., Agerlin P. M. & Byrne, D. V. (2005). Meat Science, 69, 621-634.

[3] González-Martín, I., Pérez-Pavón, J.L., González-Pérez, C., Hernández-Méndez, J. & Álvarez-García, N. (2000). Analytica Chimica Acta, 424, 279-287.

[4] Otero, L., Horrillo, M.C., García, M., Sayazo, I., Aleixandre, M., Fernández, M.J., Arés, L., & Gutiérrez, J. (2003). Meat Science, 65, 1175-1185.

[5] Santos, J.P., García, M., Aleixandre, M., Horrillo, M.C., Gutiérrez, J., Sayago, I., Fernández, M.J. & Arés, L. (2004). Meat Science, 66, 727-732.

[6] SAS, V.9 (1999). In SAS user's guide. SAS Institute Inc., Cary, NC.

.

Figure 1. Capacity of the piezoelectric sensor to discriminate the feeding background

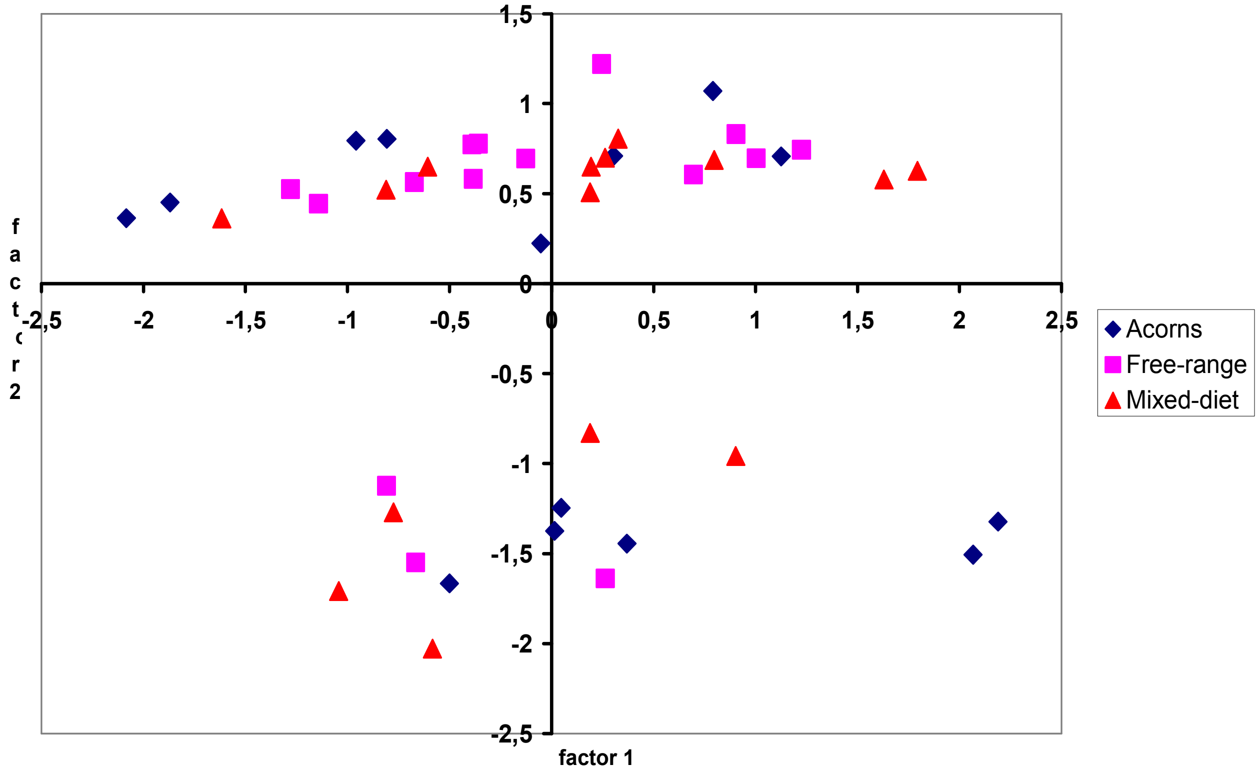

Figure 2. Capacity of the piezoelectric sensor to discriminate between days of conservation

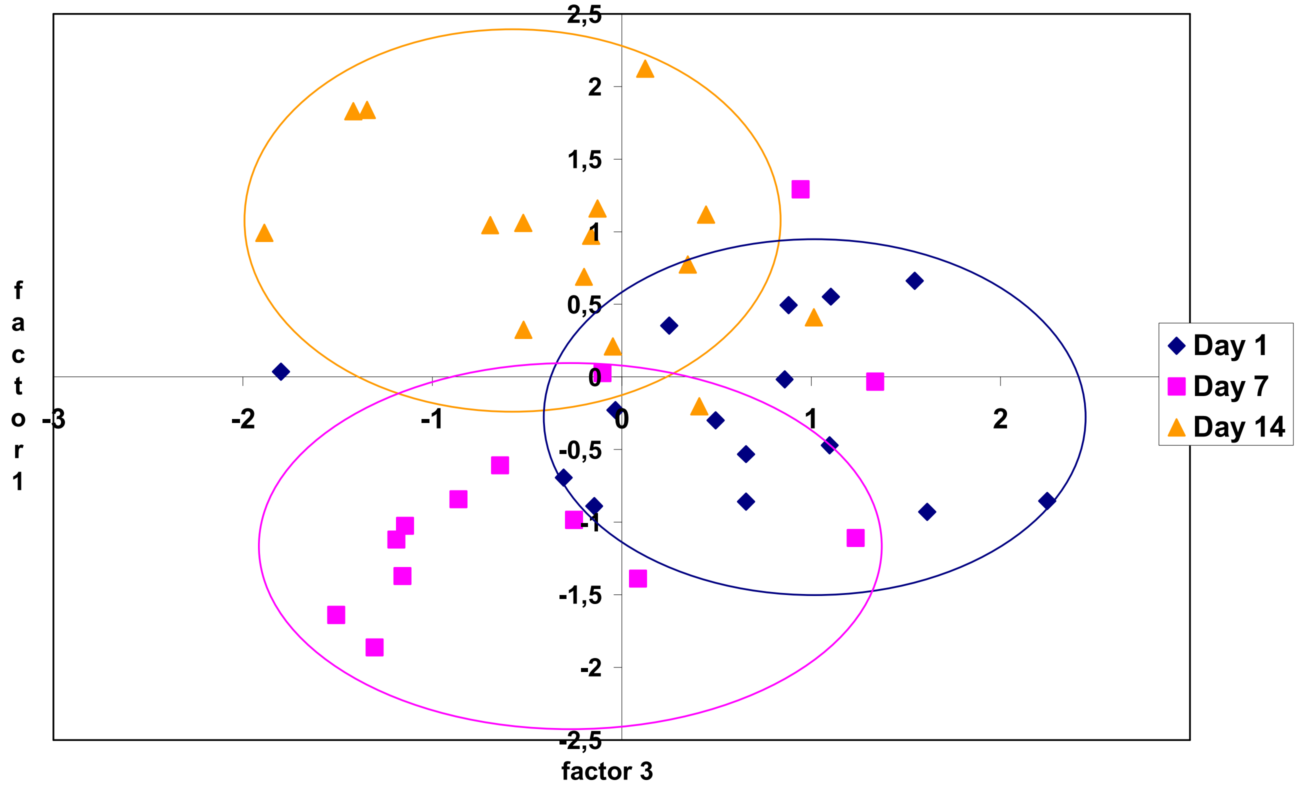

Table 1: Effect of sources of variability on the principal factors

	DIET			*P value*			RSD
	Acorn	Free-range	Mixed diet	Diet	Temperature	Day	
Factor 1	0.0643	- 0.1023	0.0579	ns	ns	ns	1.32
Factor 2	-0.2507	0.2374	-0.0320	ns	ns	ns	0.95
Factor 3	-0.2799	0.1455	0.1228	ns	ns	ns	0.98