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ABSTRACT: The use of a quartz microbalance based (QMB) electronic nose for feed traceability of fresh and cured fat of Cinta Senese pigs has been evaluated. Thirty-three pigs were fed different feeding during fattening: "three months chestnut" (3-CH), "1 month chestnut" (1-CH) "fed commercial feedstuff" (0-CH). Fresh fat and cured lard of each animal were analysed. Overall data set was analysed by factorial analysis to test if the instruments allowed a satisfactory pattern separation among groups. Afterwards, on the three factors generated by factorial analysis, a GLM procedure was applied to estimate effects such as: feeding type, operative temperature, day of analysis, order within day, layer of the subcutaneous fat. The results showed a clear separation according to feeding regimen in fresh fat only, especially between 1-CH and 0-CH, but also a strong effect of the other sources of variability. Concerning this, the date of analysis had a significant effect on each factor generated by factorial analysis that invalidated the discrimination obtained.

Key words: Electronic nose, Cinta Senese, Pig, Chestnut, Fat quality.

INTRODUCTION – The effect of the feeding on quality traits of meat and fat is particularly important in products of Cinta Senese pigs, traditionally reared on wood. At the same time it becomes important to find a way to classify and distinguish these products in order to obtain their characterization. The aromatic profile of the products is affected by the diet and could be a useful discriminating factor. This research was done to evaluate the ability of electronic nose to distinguish fresh and cured fat belonging to Cinta Senese pigs fed according to three different diets during fattening.

MATERIAL AND METHODS - Thirty-three Cinta Senese pigs were reared indoor and allotted into three groups (11 animals per group). One group fed commercial feedstuff until the slaughtering (0-CH), the other two groups fed chestnut for one (1-CH) and three (3-CH) months before slaughtering respectively. Really, chestnut diet contained a minimal supplement of bran (about 10%). Pigs were slaughtered at 130 kg of live weight on average. Backfat was spiced and seasoned for 90 days to obtain cured lards. Samples of fresh backfat and cured lard were stored at –80°C until analysis. Analysis were performed, separately for outer and inner layer, 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 "Tor Vergata", Italy). For the analysis the samples were defrosted and trimmed. Five grams of minced sample were placed into a jar and maintained at a constant temperature in a digital water bath (30°C) for ten minutes to allow a static headspace generation. Afterwards nitrogen was bubbled through the jar for 5 minutes to carry the volatile organic compounds into the sensor chamber, where 7 sensors interacted with the aromatic compounds, resulting in a difference in frequency ΔF (Hz) between the "measurement" signal and the fundamental oscillation frequency (20 MHz). Statistical analysis was carried out separately on fresh and cured fat. The whole data-set was submitted to Factor Analysis to study the relationship among sensors values, using the Varimax rotation procedure. The three first factors were submitted to a variance analysis using GLM procedure (SAS, 2003) to test the effect of feeding type, operative temperature, day of analysis, order of measure within day, layer.

RESULTS AND CONCLUSIONS - Figure 1 shows the score plot of the two principal components for fresh fat samples (from both outer and inner layer). Owing to factorial analysis the two first principal components

were chosen because they contained more than 96.20% of the total variance and concentred the most relevant information to classify the groups. The results reported in Figure 1 show how the factorial analysis has discriminated according to feeding type: 1-CH vs. 0-CH by factor 1 nevertheless a slight overlapping in the central area that can't be solved by the use of three principal components, and 3-CH vs. 0-CH by factor 2. As regards the score plot of cured fat (Figure 2), on the contrary, a separation among the groups is far to be reached. These results lead to believe that electronic nose is able to discriminate fresh fat samples according to feeding regimen contrarily to the cured fat. In fact, even if the samples were trimmed and cleaned from spices before analysis, probably the aroma was corrupted and made undifferentiated among the samples by the absorption of the molecules of the spices during seasoning period.

This deduction, even if interesting, doesn't take in to account that the overall data-set has a great variability depending on several factors as: operative temperature of instrument, day of analysis, measuring order of samples within day of analysis, layer of subcutaneous fat, so, to estimate the effect of these factors, the new data set deriving from factorial analysis was submitted to GLM.

The results (Tables 1 and 2) show that there's not significant difference among the three dietary groups neither for fresh nor cured fat. In the tables also the significance of each effect is shown and we can easily observe how much strong is the effect of the day of analysis on all the measures (P<0.01) and in general it has to be underlined the importance of all sources of variability. The comparison with other findings is very arduous because of the different types of sensors used.

On Iberian hams of pigs reared outdoors or indoors, Santos *et al.* (2004) found a good classification between groups using electronic nose equipped with a tin oxide gas sensor array. The same result was obtained by Garcia *et al.* (2006), who discriminated four different types of hams (three of them were Iberian hams coming from pigs fed different feeding systems; one was Parma ham, coming from Large White pigs) using an array of metal oxide sensors. In conclusion the use of electronic nose in our reality needs further studies both on methodological approach and statistical analysis.

Table 1.   Effect of sources of variability on the principal factors of the fresh fat samples.

	Feeding Type			P Value	P Value*				RSD
	3-CH	1-CH	0-CH		O	D	L	T	
Factor 1	-0.155	-0.124	-0.186	n.s.	n.s.	< 0.01	n.s.	n.s.	0.457
Factor 2	-0.005	-0.301	0.06	n.s.	n.s.	< 0.01	< 0.05	n.s.	0.287
Factor 3	-0.067	0.291	0.099	n.s.	n.s.	< 0.01	n.s.	n.s.	0.722

*O=Order within day, D=Day of analysis, L=Layer o fat, T= operative temperature.

Table 2.   Effect of sources of variability on the principal factors of the cured fat samples.

	Feeding Type			P Value	P Value*				RSD
	3-CH	1-CH	0-CH		O	D	L	T	
Factor 1	-0.146	0.288	-0.04	n.s.	n.s	< 0.01	< 0.01	< 0.05	0.688
Factor 2	-0.17	0.181	-0.13	n.s.	< 0.05	< 0.01	< 0.01	n.s.	0.538
Factor 3	-0.083	-0.133	-0.23	n.s.	< 0.01	< 0.01	n.s.	n.s.	0.243

*O=Order within day, D=Day of analysis, L=Layer o fat, T= operative temperature.

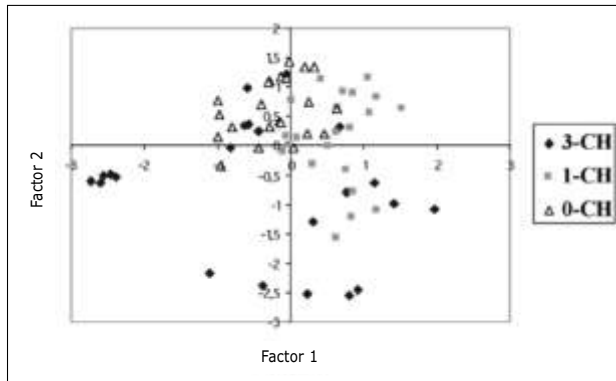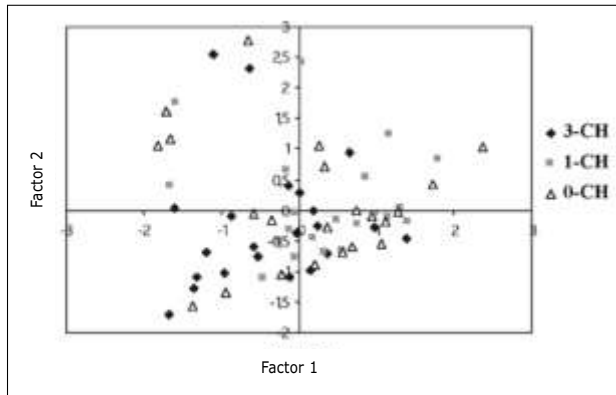Figure 1.   Factor analysis plot for the "3-CH", "1-CH" and "0-CH" fat fr

Figure 2.   Factor analysis plot for the "3-CH", "1-CH" and "0-CH" cured fat samples.

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