ME PIGMENTS EVOLUTION DURING RIPENING OF DRY CURED IBERIAN HAM

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MMARY

the elaboration of dry cured ham, nitrate and nitrite are generally applied to the surface of the thighs obtaining a stable red colour. Some me is necessary to allow these salts to reach deep muscles. However, the high content of both inter- and intramuscular fat could slow wn the diffusion process. Knowing the rates of nitrate and nitrite diffusion and myoglobin nitrosylation would be necessary before gesting changes to the processing of dry cured ham.

he aim of the present work was to analyze the evolution of heme pigments during ripening of Iberian ham, and its relation with the nditions of processing.

enty five thighs from pure Iberian and 25 from IberianxDuroc (75/25) pigs were rubbed with a mixture of salts containing nitrate and trite. Then, they were processed at environmental conditions, following the traditional method for 18 months. Sampling was carried out different stages of processing at both superficial (*Semimembranosus*) and deep (*Biceps femoris*) levels. Moisture, lipid, chloride, nitrate d nitrite content, and pH were determined. Total heme pigments, nitrosyl and metmyoglobin were quantified after extractions with HCl d acetone/water (40/10).

cording to the levels of nitrate and nitrite found in deep muscles, curing salts diffuse faster in Iberian thighs probably due to their lower ight. In spite of that a relatively high content of nitrate and nitrite was reached in both muscles on the 15th day of salting, no relevant rmation of nitrosylmyoglobin was found even after 75 days of processing. This could be due to the unfavourable pH (close to 6) and mperature (5°C) for the transformation of nitrite in nitric oxide. However, when the temperature rises a high increase in trosylmyoglobin was observed, reaching in less than 100 days a level of myoglobin nitrosylation of about a 70% of the final one. herefore, from the point of view of the colour, there is no reason to extend the maturation process for more than 9-10 months, provided at the temperature of maturation be of 20-30°C.

TRODUCTION

he colour of cured meats develops as a result of the interaction of nitrites with muscle pigments. For the nitrosylmyoglobin formation through meat pieces adequate diffusion of nitrates or nitrites and favourable conditions for their reduction are required. Colour veloping is faster in comminuted products due to the homogeneous ditribution of curing salts and acidification (ZAIKA et al. 1976). trosylmyoglobin formation in deep tissues of big meat pieces takes more time due to the required diffusion of nitrates and nitrites. The esence of high levels of intramuscular fat in Iberian thighs may difficult this process.

he aim of this work was to study the development of the colour in cured ham during the ripening and its relation with the conditions processing.

ATERIAL AND METHODS

ocessing of the hams

fty thighs were obtained from Iberian pigs (25 pure Iberian and 25 IberianxDuroc 75/25) fattened extensively, including a high amount metabolizable energy to allow a high percentage of intramuscular fat.

he selected hams were thoroughly rubbed with sea salt containing about 1% of nitrate and 0.4% of nitrite, and buried into a pile of salt d kept at 0-4°C for 15 days.

he hams were processed according to the traditional way. During the first period, low temperature was combined with high relative midity to allow diffusion of salt into the hams. Next, the temperature was slowly raised up to 30°C and the relative humidity ogressively lowered down to 40% to achieve the adequate drying of the thighs. Then, the hams were left to mature for 12 additional nths under environmental conditions in a cellar (temperature range 10-25°C and relative humidity 70-80%).

Sampling.

The hams were divided into 7 groups according to the following protocol. The number of days from the beginning of the processing, and the number of hams taken at every stage were as follows:

Refrigerated (R) 0 days n=10, Salted (S) 15 days n=4, Post-salting1 (PS1) 75 days n=4, Post-salting2 (PS2) 120 days n=5, Drying (D) 168 days n=9, Half cellar (HC) 360 days n=8 and Fully aged (FA) 588 days n=10.

Analytical determinations

Samples of *Biceps femoris* and *Semimembranosus* were taken from each ham, ground separately in a Moulinex meat grinder for approximately 5 s, and stored at -18°C until analysis.

Moisture was determined following AOAC recommended methods (AOAC-24002, 1984).

pH was measured in a small sample after homogenization in the same volume of destillated water.

To estimate the salts content, chlorides, nitrates and nitrites were extracted with water/ethanol (60/40, v/v) and quantified by the AOAC method (1984).

The total heme pigments, nitrosylmyoglobin and metmyoglobin contents were estimated following the method of HORNSEY (1956) with minor modifications (CORDOBA, 1990).

Results and discussion

In the stages carried out at low temperature (salting and post-salting 1) nitrosylmioglobin content in *Semimembranosus* and *Biceps femoris* was low (Fig. 1) in spite of the presence of nitrite (more than 30 ppm in surface and 5 ppm in deep, Fig. 3). The relatively high pH (above 6) found in the samples (Table 1) is not favourable for nitric oxide formation. This seems to agree with the low nitric oxide generation found by DEMASI et al. (1989) at pH values around 5.3 and 6. The decrease in the nitrate content can not be explained by either the increase of nitrite or nitrosylmyoglobin formation. This fact could be explained by the reaction of nitrites with different meat components (proteins, fat, etc.), as described by several authors (OLSMAN, 1977; CASSENS et al., 1979).

Nitrosylmyoglobin formation is faster in Iberian than in Iberian x Duroc samples, probably due to the fact that lower weight of the former favours salt diffusion.

Although chloride content (Table 2) is high in the first stages (salting and postsalting 1), metmyoglobin formation is low. The high pH values found are not favourable for the formation of this pigment. In this sense, TORRES et al. (1988) found that the content of metmyoglobin in meat was lower when salt was added in pre-rigor than in samples salted in post-rigor.

Although the nitrite content in PS1 is low, an increase in nitrosylmyoglobin formation was observed in Postsalting2 and Drying, where the temperature is higher. It seems that the increase in temperature favours myoglobin nitrosylation, in spite of the unfavourable values of pH.

In the first 6 months of the cellar stage (HC) there is an important increase in the nitrosylmyoglobin content. In the last 6 months of cellar a stabilization of nitrosylmyoglobin content was observed, in spite that a relevant amount of heme pigment was still in the myoglobin form. The low nitrite content in this stage must be responsible for the low nitrosylmyoglobin formation.

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ure 1.- Evolution of nitrosylmioglobin, metamyoglobin and myoglobin during ripening of Iberian ham.

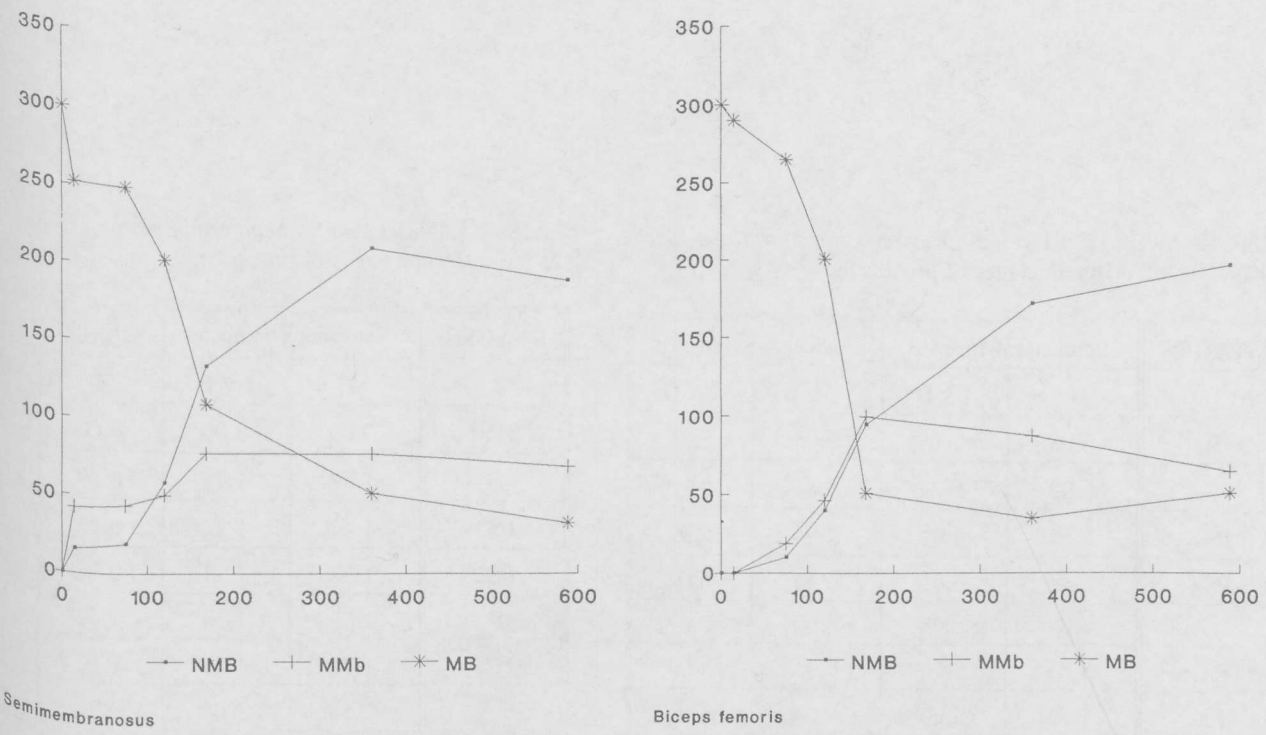
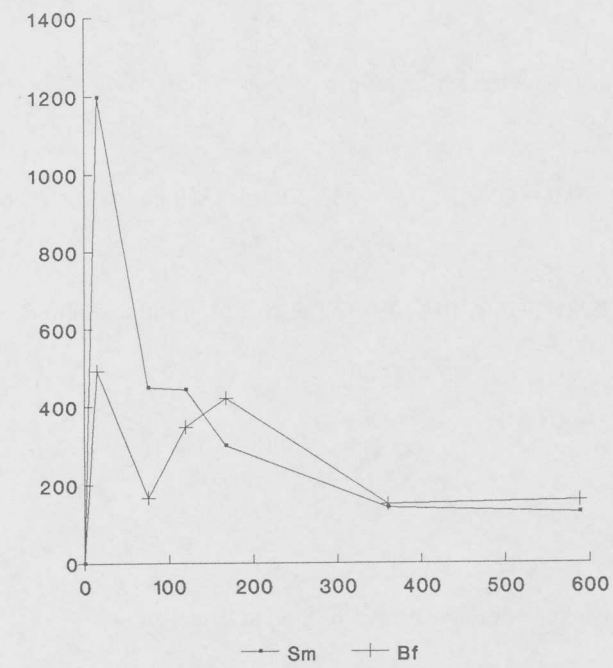
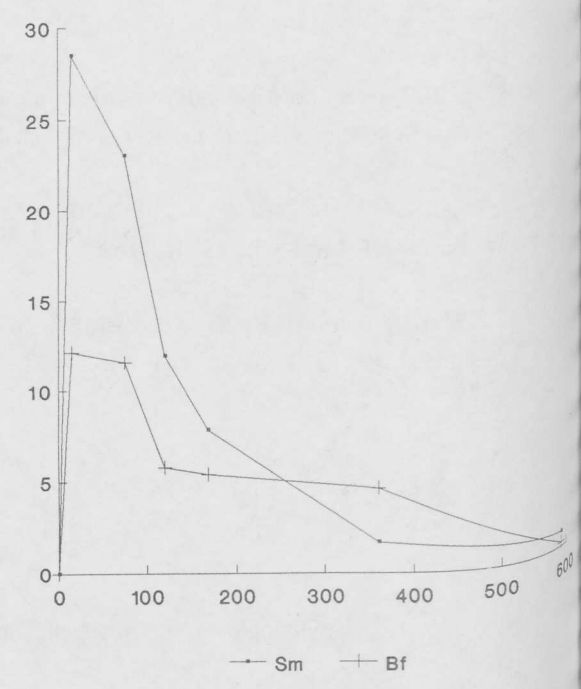


Figure 2.- Evolution of nitrates and nitrites during ripening in Iberian ham.



Nitrates



Nitrites

Table 1.- Means of pH values of and *Semimembranosus Biceps femoris* at the different stages of processing.

STAGES	Semimembranosus		Biceps	femoris
	I	I x D	I	I x D
R	6.08	6.16	6.03	5.96
S	5.92	5.71	5.81	5.70
PS1	6.15	6.02	5.94	5.97
PS2	6.14	6.01	6.14	6.02
D	6.08	6.08	6.00	6.07
HC	5.66	5.70	5.91	5.92
FA	5.73	5.70	5.94	6.04

Table 2.- ClNa content of *Semimembranosus* and *Biceps femoris* at the different stages of processing expresed as molality.

STAGES	Semimembranosus		Biceps	femoris
	I	I x D	I	I x D
R	0.00	0.00	0.00	0.00
S	1.57	1.78	0.59	0.25
PS1	1.42	1.42	0.95	0.67
PS2	1.36	1.31	0.92	0,96
D	1.59	1.34	1.32	1.29
HC	1.78	1.65	1.83	1.52
FA	2.58	2.05	2.20	1.97