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SENSORY EVALUATION OF DRY CURED HAM FROM VARIOUS CROSSBREEDS

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INTRODUCTION

Approximately 25 millions dry-cured hams are processed each year in Spain, making Spain the major producer of this pig product (Ferrer-Falcón, 1990). Nearly 92% of the hams are obtained from intensive pig production. The remainder are from the Iberian breed, either pure or crossed, which animals are reared in extensive or semi-extensive conditions. Hams from the Iberian animals accorded the top quality in the national market.

The aim of this study was to compare the eating qualities of dry-cured hams obtained from crosses coming from three terminal sires, Duroc (DU), Large White (LW) and Belgian Landrace (BL) mated with LR X LW sows and LW and BL terminal sires mated with DU X LW sows.

MATERIAL AND METHODS

Fresh meat quality characteristics

This study was undertaken with carcasses of 109 gilts and 119 barrows from five different crossbreeds, 44 DUx(LRxLW), 45 LWx(DUxLW), 51 BLx(DUxLW) and 44 BLx(LRxLW), coming from six fattening intakes. The animals were fed *ad libitum* during their growth from 25 to 97kg live weight.

The left sides of the carcasses were used to determine meat quality. The qualities of muscle pH (pH45), electrical conductivity (QM), colour (L*, a*, b*) and subjective colour. Random samples of 20 longissimus dorsi (LD) muscles were selected from each cross to determine the water holding capacities and the intramuscular lipid content (IMF). Lipid content was determined by ether extraction in a soxhlet apparatus.

Sensory evaluation of dry cured ham

A sample of 32 hams from each cross were dry-cured. The test panel was formed of five trained panellists. The hams were deboned and the cushion was divided in two cuts at 15cm from the head of the femur. The cut proximal to the ischion (AS) was used for the panel test and the other (EC) for the consumer test. The eating quality of the AF was evaluated by the panel, which assessed slices 2mm thick. For the consumer panel evaluation the, EC cut was divided into slices 2mm thick, which were sealed into 10 vacuum packs. One questionnaire was supplied to each family member older than 15 years, to ascertain the overall acceptability of each sample.

All the analyses were performed using the General Linear Model program of the SAS statistical package. Fixed effects of sex, type of cross and batch were included in all the analyses. The analyses of dry-cured ham by the consumer and panel tests included the covariate weight of the cured ham and the curing group. The panel test analyses included the testing session as a fixed effect.

RESULTS AND DISCUSSION

The least squares means and standard errors of the meat quality characteristics of LD and SM muscles are given in Table 1. The PSE incidence (pH45<5.8 and L* value>56) where 6.8% of carcasses of DU sired pigs, 11% of LW sired pigs, 23.5% of BLx(DUxLW) and 31.8% of BLx(LRxLW). The intramuscular fat content was significantly higher in the DU sired pigs (1.88%) than in the other crosses used in this study. Table 2 shows the least-squares means and standard errors of the assessments of visual and eating qualities of dry cured hams by the trained test panel. The type of cross did not significantly affect the colour of subcutaneous fat. The BF muscles from DU sired pig hams were judged paler than the BF from the other crossbreeds studied. Brightness scores were higher for the BF of DU sired pig hams than for those of LW sired pig hams. The marbling of the SM and BF muscles of cured hams were visually assessed as higher in hams from DU sired pigs than in hams from the other crosses studied.

In Table 3, the least squares means and standard errors of processing weight losses, panel evaluations of eating quality and assessments of consumer acceptability are shown. Significantly higher scores for pastiness and adhesiveness were found in hams from DU sired pigs than in hams from LW sired pigs and hams from LBx(DUxLW) and BLx(LRxLW) crosses were intermediate for those characteristics. In general the textures of hams produced by DU sired pigs (high intramuscular fat) and BLx(LRxLW) crosses were judged softer and more pasty than the hams from the other crosses studied. Otherwise there were no significant differences between crosses in flavour characteristics. The consumer acceptability was better in hams from LWx(LRxLW) crosses than in hams from BL sired crosses, with hams from BLx(LRxLW) being judged the poorest.

The positive association between porcine stress syndrome and PSE pig meat in well-conformed breeds and crosses is well recognized (Webb and Simpson, 1986; Oliver *et al.*, 1993). The results from this trial shows the lower quality (PSE-status) of the meat from the well-conformated BLx(LRxLW) animals that is supplied to the dry-cured ham industry. A significant enhancement of meat quality was obtained when DU replaced LR in the sows and BL was used as the terminal sire. This study confirms that increasing the DU genes in growing pigs produces more marbling and intramuscular fat (Wood *et al.*, 1988; McGloughlin *et al.*, 1988; Edwards *et al.*, 1992) which is accepted as a factor of importance for meat quality (Bejerholm and Barton-Gade, 1986). Increasing the proportion of DU genes leads to joints and chops being more tender (Meat and Livestock Commission (1990).

Arnau *et al.* (1992) found that panellist rated a pure DU line as a better quality than white and conformated lines. In the present study, the level of marbling was lower than in the former study. Despite panellists recording higher marbling scores for DU crosses and differences in extractable lipid of muscle, the overall acceptability to the consumers was not associated with crossbreed type, with the exception that meat from the high PSE-status BL(LRxLW) cross was the least accepted. As in fresh meat quality, the threshold value of intramuscular for enhancement dry-cured ham acceptability should be investigate in further studies.

CONCLUSION

The Duroc breed used in this study has shown to be of interest for crossing due to the good growth characteristics of the progeny, the reasonable good quality of the carcass (Blasco *et al.*, 1993) and the good quality of the meat. However, their intramuscular fat content is not high enough to be clearly detected as a desirable character. On the other hand, the BL sired pigs give carcasses of good quality, but fresh meat of poor quality, while the hams were classified as the poorest by consumers. The problem of poor meat quality might be attenuated by the inclusion of the Duroc breed in the female.

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Table 1. Least squares means (LSM) and standard errors (SE) of meat quality characteristics of *m.longissimus dorsi* (LD) and *m.semimembranosus* (SM) from five crosses.

	DU x (LRxLW) LSM	SE	LW x (DUxLW) LSM	SE	LW x (LRxLW) LSM	SE
pH45 SM	6.11a	0.06	6.08ab	0.06	6.04ab	0.06
pH45 LD	6.02a	0.05	6.07a	0.05	5.93ab	0.06
QM45 SM	4.26bc	0.38	4.32bc	0.38	4.76ab	0.44
QM45 LD	4.07b	0.34	4.06b	0.34	4.39b	0.39
pHu SM	5.71	0.03	5.66	0.03	5.62	0.39
pHu LD	5.72	0.03	5.66	0.03	5.65	0.04
QMu SM	5.22a	0.45	6.06ab	0.44	6.14ab	0.51
QMu LD	3.95b	0.33	3.89b	0.33	4.07b	0.38
L* LD	54.06c	0.60	54.45cb	0.60	54.45cb	0.69
a* LD	7.55b	0.32	8.38ab	0.32	8.37ab	0.37
b* LD	6.48	0.27	6.81	0.27	6.87	0.32
Subjective colour LD	2.59ab	0.11	2.69a	0.11	2.38b	0.10
Drip loss LD						
WHC LD	9.74	0.41	9.84	0.41	10.29	0.47
IMF (%) LD	0.192a	0.008	0.186a	0.011	0.187a	0.012
	1.88a	0.09	1.13bc	0.09	0.95d	0.09

	BL x (DUxLW) LSM	SE	BL x (LRxLW) LSM	SE
pH45 SM	5.94b	0.05	5.79c	0.06
pH45 LD	5.80b	0.05	5.77b	0.06
QM45 SM	3.49c	0.36	5.94a	0.41
QM45 LD	4.20b	0.32	5.41a	0.37
pHu SM	5.66	0.03	5.64	0.04
pHu LD	5.72	0.03	5.71	0.04
QMu SM	6.13ab	0.43	6.66b	0.49
QMu LD	5.39a	0.32	5.67a	0.65
L* LD	55.66b	0.56	57.24a	0.65
a* LD	8.85a	0.30	8.78a	0.35
b* LD	7.23	0.25	7.64	0.30
Subjective colour LD	2.37b	0.10	1.97c	0.12
Drip loss LD				
WHC LD	11.16	0.39	10.85	0.45
IMF (%) LD	0.139b	0.012	0.106c	0.016
	1.40b	0.09	0.93cd	0.09

Means with differents letters are significantly different ($P<0.05$).
QM: Quality meter (s).
WHC: Water holding capacity, absorvance units per gram of meat.
IMF: Intramuscular fat content.

Table 2. Least squares means (LSM) and standard errors (SE) of visual characteristics of the dry cured ham, obtained from five crosses.

	DU x (LRxLW) LSM SE	LW x (DUxLW) LSM SE	LW x (LRxLW) LSM SE	BL x (DUxLW) LSM SE	BL x (LRxLW) LSM SE
Colour of subcutaneous fat	8.01 0.12	7.83 0.14	7.96 0.18	7.66 0.14	8.00 0.16
Colour of BF	5.14b 0.11	5.62a 0.13	5.80a 0.16	5.41a 0.13	5.80a 0.14
Colour of SM	7.11b 0.10	7.54a 0.12	7.56a 0.15	7.49a 0.12	7.42ab 0.13
Brightness of BF	5.09a 0.33	3.24c 0.38	3.56bc 0.48	4.17abc 0.38	4.72ab 0.42
Intramuscular fat in SM	3.83a 0.24	2.66b 0.27	2.23b 0.34	2.61b 0.28	1.92b 0.30
Intranmuscular fat in BF	3.36a 0.16	2.41b 0.18	2.09b 0.23	2.75b 0.18	2.28b 0.20
Intramuscular fat in ST	3.92a 0.25	3.05b 0.29	2.35b 0.37	3.43ab 0.29	2.89b 0.32

Means with differents letters are significantly different ($P<0.05$).
BF= *m.biceps femoris*, SM= *m.semimembranosus*, ST= *m.semitendinosus*.

Table 3. Least squares means (LSM) and standard errors (SE) of processed weight loss, eating quality traits and consumer acceptability of the dry cured hams obtained from five crosses.

	DU x (LRxLW) LSM	SE	LW x (DUxLW) LSM	SE	LW x (LRxLW) LSM	SE
Weight loss post-aging %	34.4	0.5	34.9	0.6	35.7	0.7
Texture traits:						
Hardness	3.52c	0.20	4.87a	0.23	4.42ab	0.29
Crumbliness	5.37ab	0.19	4.82b	0.21	4.85b	0.27
Pastiness	4.38a	0.32	2.57c	0.37	2.66c	0.47
Adhesiveness	5.49a	0.34	3.72b	0.39	3.97b	0.50
Flavour traits:						
Saltiness	5.82	0.08	6.03	0.10	6.00	0.12
Piquantness	4.93	0.27	4.58	0.31	4.51	0.12
Bitterness	1.14	0.16	0.91	0.19	1.09	0.24
Consumer acceptability	0.13ab	0.08	0.18ab	0.10	0.40a	0.12

	BL x (DUxLW) LSM	SE	BL x (LRxLW) LSM	SE
Weight loss post-aging %	34.0	0.5	35.2	0.6
Texture traits:				
Hardness	3.80bc	0.23	3.21c	0.25
Crumbliness	5.14b	0.22	5.75a	0.24
Pastiness	3.41bc	0.38	4.17ab	0.41
Adhesiveness	4.25b	0.40	4.87ab	0.44
Flavour traits:				
Saltiness	5.73	0.10	5.83	0.11
Piquantness	4.39	0.32	4.85	0.35
Bitterness	0.97	0.19	1.09	0.21
Consumer acceptability	-0.03b	0.08	-0.26c	0.09

Means with differents letters are significantly different ($P<0.05$).