Meat quality

PORK QUALITY OF PIG CROSSBREEDS LARGE WHITE, LANDRACE, HAMPSHIRE, PIETRAIN AND DUROC.

M.D. Garrido, M.V. Granados, D. Álvarez, S. Bañón, J.M. Cayuela and J. Laencina.
Departament of Food Technology. Veterinary Faculty. University of Murcia. Espinardo, Murcia 30071, Spain.
Phone: 34 68 364708. Fax: 34 68 364147 E-mail: mgarrido@fcu.um.es.

INTRODUCTION

Technological advances in genetics, feeding and handling have favoured a recent increase in pork production levels. Attempts are being made to achieve meat with high lean content by means of genetic selection, and in order to do this breeds such as Landrace or Pietrain are being used. However, the sensitivity of these breeds to Porcine Stress Syndrome means that their selection is associated with the production of lower quality meats (Warnants et al., 1993). The traditional model for pig production consisted of a three-way crossbreed, the female being a cross between the Landrace and Large White breeds and the male contributing a good shape to the carcass. In an attempt to avoid the problems associated with Porcine Stress Syndrome, nowadays there is a trend towards the use of males who are the product of various crossbreeds, belonging to new breeds or synthetic lines. The importance of meat quality for the processing industry has caused a great deal of interest in this study on the part of pig producers in the Region of Murcia (1.184.475 animals in 1994; Estadística Agraria de Murcia 1994). In the study, the quality of the meat of four of the pig crosses most commonly used in Spain is evaluated.

OBJECTIVES

The objective of this study is evaluate the pork quality of carcass from four common pig crosses: Females: Landrace and Large White; Males: Pietrain, Large White, Landrace, Hampshire and Duroc.

MATERIALS AND METHODS

Animals and slaughterhouse: Two hundred and four animals were studied. The pigs belonged to four different crossbreeds (females: Landrace x Large White; males: **A:** Pietrain x Large White x Landrace, **B:** Pietrain x Large White x Hampshire, **C:** (Pietrain x Large White x Hampshire) x Pietrain, **D:** Duroc x Pietrain. The animals were stunned using CO_2. The carcasses were chilled at flow rate of 3m/s at 0ºC for 90 min. *Measurements on the slaughterline:* The lean percentage of the carcasses was determined by reflectance (Fat-O-Meater, SFK, Denmark) at a depth of 6 cm. The thickness of the dorsal backfat was taken at the first rib level. Measurements of pH were taken in the *longissimus dorsi* (LD) muscle at 45 min and 24 h *post mortem* using a portable Crison 507 pH-meter (Crison Instruments) with a Xerolyt combined penetration electrode (Ingold Electrodes Inc.) *Exudation and colour measurements:* Exudation and colour measurements were taken in the LD muscle. Drip loss was determined according to Hönikel et al. (1986). Press loss was determined according to the filter paper technique (Grau and Hamm, 1957). The value was expressed as a percentage of Water Holding Capacity (WHC). Cooking loss was measurement according to Fernández et al. (1994). Colour was marked subjectively from 1 (palest) to 6 (darkest) according to the Japanese scale (Nakay et al., 1975) and measured by reflection with a Chroma Meter II Reflectance CR-200 colorimeter (Minolta Ltd.). The value was expressed according to the L* a* values of the CIELab system (CIE, 1975). Haem pigments were determined according to Garrido et al (1994a). *Intramuscular fat:* The intramuscular fat was determined according to the Soxhlet method (ISO R-1433, 1979). *Statistic:* The statistical survey consisted of descriptive statistics techniques and one-way variance analysis (Scheefe´s means homogeneity test). The computer programs used were Statical Graphics System 2.1 (Statical Graphics Corporation) and Statixtics 3.5 (Analytical Software).

RESULTS AND DISCUSSIONS

Table 1 shows the mean values and standard deviations of the measurements taken in the carcass on the slaughterhouse line. The heaviest carcasses were those of pig crosses B and D. The highest lean meat percentages and the thinnest dorsal backfat were found in C and D type carcasses. There were significant differences ($p<0.05$) between the average lean meat percentages in A, B and C carcasses. The pH of the LD muscle 45 minutes after slaughter was somewhat lower in C loins, whilst the final pH value was significantly higher ($p<0.05$) in D loins.

Table 2 shows the mean values and standard deviations of the exudation and colour measurements in the four crossbreeds of pig studied. The highest levels of press loss were those of C meats (WHC: 67,6%), and the lowest figures were those of D (WHC: 71,4%). The drip loss was also less important in D (6,9%), the highest figures here being those of B (9,4%). As for cooking loss, again the lowest figures were those of D, (5,8%) while the highest were those of C (9,5%). Meat colour was described as "pale to normal" (2-3) in all the types of meat studied. The pigs of crossbreeds A and C produced slightly paler meats than those of crossbreeds B and D. Similarly, the mean value of the a* co-ordinate was significantly higher ($p<0.05$) in B (5,9) and D (6,0) compared to A (5,0) and C (5,1). At the same time, there was a higher haem pigment content ($p<0.05$) in D meats (1.4 mg/g). Finally, the intramuscular fat percentages in the LD muscle for the four types studied were as follows: A (1,29±0,49); B (1,32±0,46); C (0,97±0,35); and D (1,19±0,56). Significant differences ($p<0.05$) were found in the mean intramuscular fat figures between types A and C.

The quality characteristics of crossbreed A pigs (Pi x La x LW) (less well-shaped carcasses and paler meats, with low exudation levels) mark them out as intermediate in comparison to the other crossbreeds studied. Crossbreed B (Pi x LW x Ha) does not give such lean carcasses, and, furthermore, the carcasses have high levels of drip loss and cooking loss. Crossbreed C pigs ((Pi x LW x Ha) x Pi) produce the leanest carcasses of the four genetic types studied. However, these animals produce lower quality meats, characterised by high exudation levels and less fat infiltration, as was shown by Oliver (1991). Lastly, pigs from crossbreed D also produced lean carcasses although, unlike the other crossbreeds, the meat obtained had lower levels of press loss, drip loss and cooking loss. This is typical of the Duroc breed and its crossbreeds (Barton-Gade, 1990). However, despite the hypotheses of other authors (Wood et al., 1989; Blasco et al., 1993), these meats did not have higher intramuscular fat content. This may be due to the different genetic origin of the lines used for our study.

From the data collected it can be concluded that the overuse of Pietrain males in crossbreeds of pigs with Landrace x Large White females, despite producing a better lean carcass, results in leaner and more exudative meats in comparison with the meat obtained from other genetic varieties. On the other hand, the use of Duroc males also produces high levels of slaughterline yield and better quality, darker meats, which have a higher water holding capacity and are therefore juicier, suffering less liquid loss in cooking. These quality characteristics are more in accordance with consumer preferences and the demands of the transformation industry.

CONCLUSSIONS

The overuse of Pietrain males in crossbreeds of pigs with Landrace x Large White females, despite producing a better lean carcass and more exudative meats in comparison with the meat obtained from Landrace, Large White, Hampshire and Duroc breeds. The use of Duroc males also produces high levels of slaughterline yield and better meat quality. Therefore it is advisable that the use of males from the Duroc breeds should be reconsidered in crossbreeds of pigs.

REFERENCES

Barton-Gade, P.A. (1990). Proc 4th World Cong Gen App Livest Prod, Edinburgh, 511. Blasco, A.; Diestre, A.; Estany, J.; Gispert, M.; Gou, P.; Noguera, J.L.; Oliver, M.A.; Soler, J.; Tibau, J. (1993). Anaporc, 126. Commission Internationale de l'eclairage (1975). Publication 36. Estadística Agraria de Murcia (1994). Gobierno de la Región de Murcia. Fernández, X.; Forslid, A. y Tornberg, E. (1994). Meat Sci **37**: 133. Garrido, M.D.; Pedauyé, J.; Bañón, S. y Laencina, J. (1994). Fleischwirts. **74** (11): 120. Grau, R.; Ham, R. (1957). Naturwissenschaften **40**: 29. Honikel, K.O.; Kim, G.J.; Roncales, R., Hamm, R. (1986). Meat Sci **16**:267. ISO, R-1443. (1979). Nakay, H.; Saito, F.; Ikeda, T.; Ando, S.; Komatsu, A. (1975). Bulletin nº 29. National Institute of Animal Industry, Japan. Oliver, M.A. (1991). PhD Thesis. Univ Autónoma of Barcelona. Warnants, N.; Eeckhout, W.; Boucqué, CH.V. (1993). J Ani Breed Gen 110, 357. Wood, J.D. Enser, M.; Whittington, F.M.; Moncrieff, C.B.; Kempster, A.J. (1989). Livest Prod Sci 22: 351.

Table 1: Mean and standard deviation values measurements on the slaughterline for four different pig croosbreeds.

	CROSSBREEDS			
	A	B	C	D
N	46	60	55	43
Weight	74.6±7.9^a	86.9±9.7^b	70.6±8.1^a	87.0±9.2^b
Lean	54.1±3.3^a	53.6±2.6^a	56.8±2.5^b	55.4±4.9^{ab}
Dorsal Fat	3.1±0.8^a	3.6±0.7^b	3.0±0.7^a	3.1±0.6^a
pH45	6.2±0.4^a	6.2±0.2^a	6.0±0.3^b	6.1±0.3^{ab}
pH24	5.5±0.1^a	5.5±0.2^a	5.4±0.1^a	5.6±0.3^b

Means with differents superscrits are significantly different ($p<0.05$).
A: (Pi x LW x La) x (La x LW); B: (Pi x LW x Ha) x (La x LW); C: [(Pi x LW x Ha) x Pi] x (La x LW); D: (Du x Pi) x (La x LW).
Weight (Kg); Lean (%); Dorsal fat (cm);

Table 2: Mean and standard deviation values of exudation-colour measurements in the *longissimus dorsi* muscle for four different pig croosbreeds.

	CROSSBREEDS			
	A	B	C	D
Exudation				
PL	69.7±3.0^{ab}	69.0±3.0^{bc}	67.6±3.8^c	71.4±4.2^a
DL	7.4±2.3^a	9.4±2.3^b	8.3±2.7^{ab}	6.9±3.1^a
CL	6.5±1.1^{ab}	8.3±3.3^a	9.5±3.7^a	5.8±3.6^b
Colour				
Colour	2.3±0.6^a	2.8±0.7^b	2.4±0.6^a	2.9±0.8^b
L*	43.3±4.7	43.3±3.7	45.1±4.4	44.8±3.4
a*	5.0±1.2^a	5.9±1.2^b	5.1±1.2^a	6.0±1.2^b
PIG	1.2±0.2^a	1.2±0.2^a	1.1±0.2^a	1.4±0.2^b

Means with differents superscrits are significantly different ($p<0.05$).
PL: Press Loss (%); DL: Drip loss (%); CL: Cooking Loss (%). Colour (1-6); CIE L* (0±100) and a* (0±60).
PIG: haem pigment (mg/g).