INFLUENCE OF GENOTYPE ON CARCASS QUALITY OF CELTA PIG BREED

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Abstract— **The influence of genotype on carcass quality of Celta pig breed was studied. A total of 16 Carballina line and 20 Barcina line pigs from the Celta breed were used. The average carcass weight, 149 and 138 kg for Carballina and Barcina line respectively, were higher than the average commercial pig slaughtered in Galicia and Spain. On the other hand, we observed significant differences (P<0.05) respect to chilling losses (1.84 *vs.* 2.21, for Carballina and Barcina line, respectively). With regard, the morphometric parameters, there were no statistically differences between genotypes except for the DFT1 (P<0.01) and DFT2 (P<0.05), since these parameters were always higher in carballina line. Genotype had statistically significant effect on the proportionality of some individual joints: head loin, ham, jowl, baicon and head. For the rest of joints, differences between sexes were small and not significant. The PCA offered a good separation of the mean samples according to the carcass quality. The PC1 axis was mainly characterized by slaughter weight, HCW, CCW, CL, LL, HmL, ham and shoulder. The variables that were positively aligned with PC2 were ETD2, ETD3, ETD4 and baicon, while killing out was positively aligned with PC3.**

Keywords— **Celta pig breed, Carcass quality, Morphometric measurement**

I. INTRODUCTION

The Celta pig was the most important breed in Galicia (northwest of Spain) until beginning of the 20th century, suffering from this moment a continuous decrease caused by the introduction of improved breeds and their crosses. The Celtic stock derives from the crossing of *Sus Scrofa ferus* with subgenus s*triatosus*. Apart of Celta breed, the Celtic racial group spread across the north of Spain giving rise to several breeds that still survive today in different degrees of purity such as the "Chato", "Lermeño", "Molines", "Alistano" from Alava, Burgos, Guadalajara and Zamora provinces, respectively. In 1951, only fourteen percent of porcine population, reared in Galicia belonged to Celta pig and the breed was close to disappearing. Nowadays, Celta pig is the unique autochthonous pig breed of the Galicia included in the Official Catalogue of Cattle's Breeds of Spain as being in danger of extinction [1]. Celta pig breed has benefited from a breeder's association since 1999 (Asociación de Criadores de Ganado Porcino Celta-ASOPORCEL) as well as a Record of Births of Stud-Book [2], so in recent years its number has been growing, with about 750 sows in 2010 [3].

The objective of this work was to study the effect of genotype (carballina vs. barcina) on carcass characteristics of Celta pig breed, reared on their typical production system.

II. MATERIALS AND METHODS

A. Experimental Design and Animal Management

For this study, 16 carballina line and 20 barcina line pigs from the Celta breed were used. All specimens, registered in the Record of Births of Stud-Book, were obtained from ASOPORCEL (Lugo, Spain). All animals were reared together in a single group in an extensive system. They were fed "ad libitum" with commercial concentrate suited to the nutritive needs of the animals. All animals were slaughtered at 14 months age. The day before slaughter, the animals were weighted and transported to the abattoir trying to minimize their stress. Pigs were slaughtered in an accredited abattoir using carbon dioxide to stun.

B. Carcass measurements

After slaughter, carcasses were weighted (hot carcasses weight, HCW). Morphometric parameters such as carcass length (CL), hand length (HL), leg length (LL), ham length (HmL), maximum perimeter of the ham (HmP) and wrist perimeter (WP)) were measured using a flexible tape on the hanging right half of the carcass at 45 min *post-mortem* following the method described by [4]. The dorsal fat thickness (DFT) was also measured with a flexible tape at the level of the first rib (DFT1), the last rib (DFT2), in the *Gluteus medius*, in the thickest dorsal fat area (cranial extreme, DFT3), and in the least dorsal fat thickness area (DFT4) [4]. Carcasses were chilled at 4°C in a cold chamber for 24 h and cold carcasses weight (CCW) was recorded. Chilling losses were estimated as the difference between HCW and CCW relative to HCW and expressed in percentage. The killing out percentage was calculated as the CCW expressed as a proportion of the slaughter weight. The day after slaughter, dissection of the left half-carcass was carried in the pilot plant of our centre. Thirteen joints were obtained (top loin, loin, sirloin, ham, shoulder, belly, bacon, jowl, fat, head, brisket, loin bone and tail) and weighted using calibrated scales sensitive to 50 g (Teaxul, mod. TXL-1075-E, Spain).

III. RESULTS AND DISCUSSION

Slaughter traits, carcass and morphologic measurements and primal cuts are shown in Table 1. Hot and cold carcass weights were not significantly different between genotypes. The average carcass weight, 149 and 138 kg for Carballina and Barcina line, respectively, were higher than the average commercial pigs slaughtered in Galicia and Spain (85.8 and 76.6 kg; [5]). On the other hand, we observed significant differences ($P<0.05$) respect to chilling losses (1.84 *vs.* 2.21, for Carballina and Barcina line, respectively).

With regard to the morphometric parameters, there were no statistical differences between genotypes except for the DFT1 ($P<0.01$) and DFT2 ($P<0.05$), since these parameters were always higher in carballina line. The CL mean value (above 90 cm, Table 1) was lower than showed by [6] in pigs of the Celtic stock, slaughtered with live weight/HCW similar to presented in this work. Other authors like [7] reported CL of 76.5 cm in Iberian pigs (slaughter at 482 days), whereas [8] found values of 76.9 and 76.5 cm for Torbiscal and Guadyerbas lines, respectively, in Iberian pigs slaughtered with live weight/HCW (140 and 110 kg) within the same range to the presented in this work. In general, obtained values indicated that the Celta pig breed produces carcasses very similar to those obtained from cross-bred white pigs.

Genotype had statistically significant effect on the proportionality of some individual joints: head loin, ham, jowl, baicon and head. For the rest of joints, differences between sexes were small and not significative. Ham, head loin, loin, sirloin and shoulder are the most valuable primal cuts, labelled in Spain as noble pieces. Carballina line produced higher weights for the most valuable meat cuts (Table 1) because these animals had a higher weight carcass. However, the sum of noble pieces respect to carcass weight was the same for both lines (44%).

Principal component analysis allows to obtain a better overall idea of the relation between variables. The first two principle components (PC1 and PC2) showed the main structured information and explained 70.86% (44.13% and 26.73% respectively) of the variation between samples (Fig 1.a). Adding an extra principal component increased this explained variance value to about 80.68% (Fig 1.b). Figure 1(a) shows a clearly separation between Carballina and Barcina lines. As can be seen, mean value for carballina genotype is at the positive side of PC1 and in the positive side of PC2, mean value for barcina genotype is at the negative side of PC1 and in the negative side of PC2. In Figure 1(b) mean Carballina line is at the negative side of PC1 and in the positive side of PC3, while mean Barcina line appear at $PC1 > 0$ and in the negative side of PC3.

The PC1 axis was mainly characterized by slaughter weight, HCW, CCW, CL, LL, HmL, ham and shoulder. The variables that were positively aligned with PC2 were ETD2, ETD3, ETD4 and baicon, while killing out was positively aligned with PC3.

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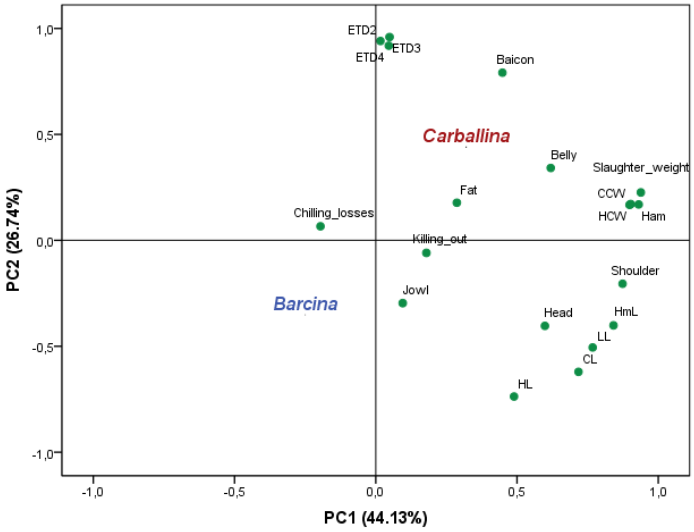
Table 1.- Slaughter weight, carcass weight, carcass measurements and carcass cut of two genotypes of Celta pig breed.

	Carballina	Barcina	SEM	SIG
Slaughter weight (kg)	149.34±17.81	138.17±17.23	3.04	n.s.
HCW (kg)	116.26±13.86	110.87±17.30	2.67	n.s.
CCW (kg)	114.13±13.65	108.45±17.12	2.64	n.s.
Chilling losses (%)	1.84±0.40	2.21±0.41	0.07	*
Killing out (%)	77.92±3.28	80.00±4.26	0.65	n.s.
Carcass measurements (cm)				
CL	90.43±6.71	92.57±5.70	1.02	n.s.
LL	69.47±3.98	70.00±5.21	0.77	n.s.
HL	38.80±2.57	40.70±2.64	0.45	n.s.
HmL	42.70±2.94	42.23±2.85	0.47	n.s.
HmP	72.47±10.94	72.40±3.85	1.27	n.s.
WP	19.13±1.80	18.80±1.51	0.29	n.s.
DFT1	5.94±0.83	4.93±0.88	0.16	**
DFT2	4.44±0.96	3.45±0.95	0.17	*
DFT3	5.20±0.95	4.41±0.93	0.17	n.s.
DFT4	4.40±0.75	3.81±1.06	0.16	n.s.
Primal cuts (%)				
Top loin	1.55±0.24	1.18±0.29	0.05	**
Loin	2.39±0.48	2.23±0.37	0.07	n.s.
Sirloin	0.49±0.07	0.46±0.08	0.01	n.s.
Ham	12.64±1.37	11.57±1.47	0.25	*
Shoulder	8.16±0.98	8.21±1.13	0.17	n.s.
Belly	3.20±0.41	3.14±0.59	0.08	n.s.
Baicon	10.49±2.11	7.64±2.00	0.40	**
Jowl	3.00±0.61	4.55±0.70	0.17	***
Fat	4.19±1.47	5.63±2.11	0.32	n.s.
Head	9.25±1.47	10.45±1.65	0.28	*
Brisket	2.10±0.47	1.91±0.38	0.07	n.s.
Loin bone	1.95±0.54	2.27±0.58	0.09	n.s.
Tail	0.29±0.05	0.35±0.12	0.02	n.s.

Significance: *** (p<0.001), ** (p<0.01), * (p<0.05), n.s (not significant)



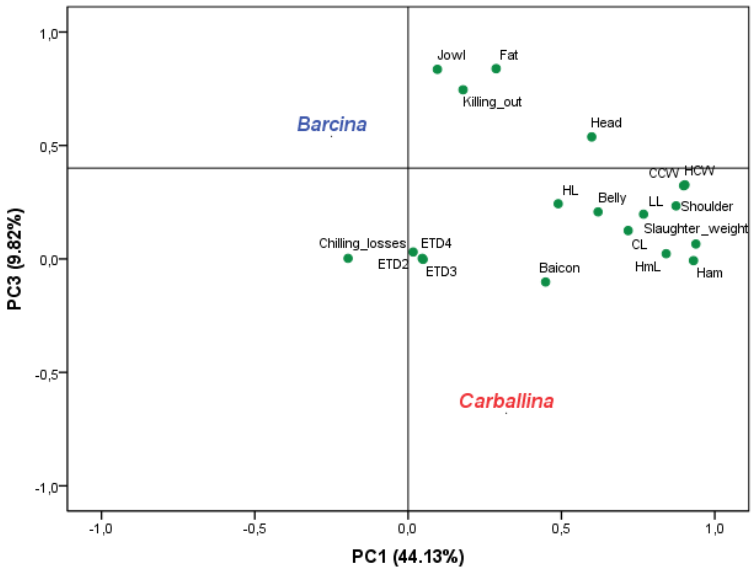


Figure 1 (a) and (b). Relationships between breed and carcass measurements obtained by PCA a) Projection of the variables and two breeds in the plane defined by the first two principal components b) Projection of the variables in the plane defined by PCs first and three.

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