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Differences in physico-chemical composition of loin of three sires from Duroc x Iberian cross selected according to their conformation

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Abstract. In the study we are going to determine the influence of animal selection taking into account its anatomical conformation in relation to the physico-chemical composition and the colour of the loin from the offspring of three Duroc (DU) boars with different anatomical conformation, and Iberian sows. Thus, 29 loins from the barrows of the offspring of DU x Iberian were analyzed. All animals were reared on the same farm in intensive regimen and fed with the same type of feed. The loin and ham pH were determined 45 minutes and 24 hours postmortem. We also determined the pressure-induced weight loss, water activity, the colour (L, a* y b*) and the chemical composition (moisture, fat, protein and ashes) of the *Longissimus dorsi* muscle. Significant differences were found in the three pig sires studied for the content of protein and fat. In this way, the samples from the least conformed sire had the highest fat content, whereas the samples from the most conformed sire had the most protein content.

Keywords. Duroc x Iberian – Anatomical conformation – Physico-chemical composition – Colour.

Différences de composition physico-chimique de la longe de trois lignées croisées Duroc x Ibérique sélectionnées en fonction de leur conformation

Résumé. *L'objectif de cette étude consistait à déterminer l'influence de la sélection animale pour les paramètres productifs de la première lignée obtenue de trois mâles de race Duroc (DU) et trois femelles Ibériques sélectionnées selon leur conformation anatomique. 29 longes de mâles castrés du croisement DUxIbérique ont été analysées. Tous les animaux ont été élevés dans la même ferme avec un régime intensif et nourris avec le même type de tourteau. Le pH de la longe et du jambon, à 45 minutes et 24 heures post mortem, les pertes de poids par pression, l'activité de l'eau, la couleur (L, a* et b*) et la composition chimique (humidité, matière grasse, protéines et cendres) du muscle* Longissimus dorsi*, ont été déterminés. Dans les trois lignées on a trouvé des différences significatives pour la teneur en matière grasse et en protéines. Les échantillons appartenant à la lignée la moins bien conformée ont montré la teneur la plus élevée en graisse, tandis que les échantillons appartenant à la lignée mieux conformée ont montré la teneur en protéines la plus élevée.*

Mots-clés. *Duroc x Ibérique – Conformation anatomique – Composition physico-chimique – Couleur.*

I – Introduction

The Iberian pig breed has recently increased in popularity because consumers value the high quality of the meat and meat products. The main characteristic that differentiates the Iberian pig from other breeds of white pig is its higher intramuscular fat content. Various studies have demonstrated that the meat from the Iberian pig is of higher quality than that which is obtained from industrial pigs (Estévez et al., 2003).

However, the Iberian pig has a slow growth rate as well as a low reproductive rate. Thus, in order to increase its productivity, it is frequently crossbred with the Duroc white pig at a level of 50% to 75% (B.O.E., 3/11/2007). This raises its reproductive capability, improves the growth

rate and increases alimentary efficiency and lean fat content (Dobao et al., 1986) without a significant reduction in either the quality of the meat, meat products (López-Bote, 1998) or the parts of the pig that are highly regarded and considered of higher quality than others (García-Macías et al., 1996). In general, the genetic lines of the Duroc and its crosses yield carcasses with a higher fat content than the conventional white line, depending on the selection line of the Duroc, the percentage of Duroc genes in the final product and the line with which it is crossed.

The overall objective of this study was therefore to determine the quality of pork loin of the genetic cross between Duroc and Iberian pigs according to the anatomical configuration by means of the determination of the physical-chemical composition and the colour.

II – Materials and methods

1. Animals

Twenty-nine pigs bred from pure Iberian females and a varied group of Duroc males were slaughtered. All of the animals were castrated, reared on the same farm and followed a strict diet consisting of the same type of feed that was changed based on the stage of growth.

2. Samples

The muscle Longissimus dorsi (loin) was taken from the carcass. The samples were then placed into three categories depending on the anatomical configuration of the male Duroc progenitor.

To make a physical-chemical analysis, the sample was triturated with a mincer until a homogenous mass was obtained. This mass was preserved in hermetically sealed jars at a temperature of -20ºC to prevent changes in its composition.

To determine the colour, the fillets were exposed to the air for 45 minutes to allow oxygenation and the measurement was subsequently taken.

3. Physical-chemical determinations

The pH was measured 45 minutes and 24 hours post mortem by direct measurement with a Crison 2002 (Crison Instruments S.A., Barcelona, Spain) pH-meter with a penetrative electrode. The water activity was also determined by direct measurement with a Decagon Devices CX-2 (Decagon Devices Inc., Pullman, WA, USA) dew point water activity meter. The water retention capacity (loss of weight due to pressure) was determined by calculating the percentage of water that was liberated by the meat when it was subjected to a pre-determined amount of pressure in accordance with the method described by Grau and Hamm (1953) and modified by Sierra (1973). The humidity was determined in accordance with Regulation ISO R-1442 (1973). The fat was extracted with 40-60º petroleum ether in accordance with Regulation ISO R-1443 (1973). The total nitrogen quantity was determined utilizing the Kjeldahl method (AOAC 1980, method 16245). The nitrogen protein content was obtained multiplying the total nitrogen value by a factor of 6.25. The ash content was determined by the method described in Regulation ISO R-936 (1973).

4. Colour determination

The instrumental measurement of the colour was taken on a loin fillet employing a Konica Minolta (CM-2600d) mobile spectrophotometer. D65 brightener was used and measurements were taken under reflective conditions. The parameters were L* (Luminosity), a* (redness) and b* (yellowness).

5. Statistical treatment

To determine the physical-chemical composition and colour, the analysis was made on the variance (ANOVA) of a factor to study the influence of the configuration of the animal. When the interaction was significant, the averages were compared using the Student-Newman-Keuls test by means of the SPSS 17.0 for Windows XP (License UCLM 7876875) statistical program.

III – Results

The average values and standard deviations of the compositional physical-chemical parameters of the male pork loin obtained from the cross between the Duroc and Iberian pigs of various configurations are show in table 1 (A: light configuration; B: medium configuration; C: high configuration).

Table 1. The average values and standard deviation of the compositional physical-chemical parameters of the male pork loin obtained from the cross between the Duroc and Iberian pigs of various configurations

	A	B	C
Pork loin pH 45 minutes	6.09±0.27	6.28±0.21	6.17±0.23
Pork loin pH 24 hours	5.53±0.12	5.59±0.28	5.62±0.22
Ham pH 45 minutes	6.43±0.32	6.54±0.35	6.17±0.11
Pressure-induced weight loss (%DM)	10.79±2.13	9.40±2.23	12.20±4.04
Water activity	0.994±0.001	0.995±0.003	0.994±0.001
Moisture	69.30±1.62	68.94±1.36	67.52±3.57
Protein (%DM)	71.76^{a}±0.86	70.62^{a}±0.90	75.18^{b}±1.14
Fat (%DM)	27.79^{a}±5.17	20.81^{b}±4.23	19.64^{b}±4.67
Ash (%DM)	3.66±0.26	3.51±0.37	3.45±0.47

DM: Dry matter.
Superscripts (a,b) in any row and for the same factor denote significant differences (P<0.05) according to the Student-Newman-Keuls test.
A: light configuration; B: medium configuration; C: high configuration.

Significant differences were not found (P<0.05) for the pH values, pressure-induced weight loss, water activity, moisture or ash content; similar values were shown for the various configurations. However, significant differences were found (P<0.05) for protein and fat content. The pigs with light configuration (A) showed the highest fat content while the pigs with high configuration (C) showed the highest protein content. These results can be explained by the fact that at a higher configuration, there is a higher quantity of muscle and thus higher protein content and lower fat content is expected.

The average values and standard deviation for the parameters that define the male pork loin colour obtained from the cross between the Duroc and Iberian pigs of various configurations are shown in Table 2. Significant differences were found (P<0.05) for the value of a* (redness), being higher in the males of light and medium configuration.

Table 2. The average values and standard deviation for the parameters that define the male pork loin colour obtained from the cross between the Duroc and Iberian pigs of various configurations.

	A	B	C
L* (Lightness)	50.56±2.59	50.16±4.33	50.12±5.71
a* (redness)	5.35[a]±1.53	4.99[a]±0.92	3.69[b]±1.35
b* (yellowness)	13.75±1.32	14.04±3.52	13.39±2.05

Superscripts (a,b) in any row and for the same factor denote significant differences (P<0.05) according to the Student-Newman-Keuls test.
A: light configuration; B: medium configuration; C: high configuration.

IV– Conclusions

(i) Similar values were found for the pH, loss of weight due to pressure, water activity, humidity and ash content for the three lines of varying configurations that were studied.

(ii) The light configuration line (A) showed the highest fat content while the high configuration line (C) showed the highest protein content and lowest a* (redness) value.

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