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Effect of different Duroc line sires on carcass composition, meat quality and dry-cured ham acceptability

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Abstract

Carcasses of 399 malignant hyperthermia gene free pigs from crosses sired by three types of Duroc (Virgen de la Fuente, DU1; Diputación de Teruel, DU2; DanBred, DU3) were analyzed for carcass and meat quality. Carcass leanness and fat parameters were measured at the last rib and at the space between the 3rd and 4th last ribs counting from the last one. Weights, pH, electrical conductivity, colour and intramuscular fat were also measured. A sample of 133 legs per cross were processed by dry-curing. The ham portion including *Biceps femoris*, *Semimembranosus* and *Semitendinosus* muscles was evaluated for instrumental texture and colour, biochemical and sensory analyses and acceptability (trained panel and consumers). DU3 carcasses were well conformed but lean. DU1 carcasses had a lower conformation but higher marbling. DU2 carcasses were intermediate. Dry-cured hams from DU1-sired pigs had a higher overall acceptability, although fat content influenced a consumers group negatively. Leaner DU3 hams had the lowest acceptability.
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1. Introduction

The Duroc breed was introduced in Europe mainly due to its higher intramuscular fat content compared to other breeds (Barton-Gade, 1987). It is generally accepted that an increased level of intramuscular fat has a positive influence on sensory qualities of pig meat and meat products (Steane, 1986), although the consumer response is variable (Wood, Edwards, & Bichard, 1988). A careful examination of the literature reveals contradictory results. Some studies indicated, or suggested, a positive effect of intramuscular fat level on sensory attributes of fresh pork (Barton-Gade & Bejerholm, 1985; Eikelenboom, Hoving-Bolink, & Van der Wal, 1996), whereas some others did not show any influence (Lentsch, Pruska, Fedler, Meisinger, & Goodwin, 1991; Purchas, Smith, & Pearson, 1990), or even a negative influence (Cameron, Warriss, Porter, & Enser, 1990; Lan, McKeith, Novakofski, & Carr, 1993).

Fat contributes to the technological and sensory quality of dry-cured ham (Antequera et al., 1992; Girard, Goutefongea, Monin, & Touraille, 1986); it influences aroma development due to the lipolytic and oxidative processes that occur during the curing process (López et al., 1992). Knowledge regarding the influence of fat content and fatty acid composition on the textural characteristics of dry cured ham is scarce and contradictory. For

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example, Bergonzoni, Rosi, and Fabbri (1985) and Parolari, Rivaldi, Leonelli, Bellati, and Bovis (1988) reported a positive relationship between tenderness of dry cured ham and lipid content. On the contrary, Buscailhon et al. (1994) found no relationship between textural traits and the lipid fraction. Considerable research has been conducted to assess the role of fat in the quality of hams from Iberian pigs, possibly due to its relation to the effect of feeding regimes; however, no research has been conducted on hams from non-Iberian pigs.

Approximately 42.1 million dry-cured hams were produced in Spain in 2004. Nearly 92% are obtained from intensive pig production with the remainder from the Iberian breed, either pure or crossed with Duroc sires, reared in extensive or semi-extensive conditions. The most common crosses used in intensive pig production in Spain result in well conformed carcass yield (Oliver et al., 1994). This strategy has led to changes in meat composition that present difficulties for dry-cured ham processing (Guerrero, Arnau, Maneja, & Gou, 1993) due to poor meat quality, low fat levels and blocky muscular mass. Duroc breeds may provide solutions to this problem due to the higher intramuscular fat content of their meat compared to common industrial crosses of Landrace and Large White.

The aim of this paper was to assess the effect of three different Duroc genetic lines on carcass and meat quality, particularly fat content and distribution, and relate these to the sensory characteristics and acceptability of dry-cured hams produced from these pigs.

2. Material and methods

2.1. Animals

A total of 48 sires, 16 from each line of Duroc (Virgen de la Fuente, Valderrobres, DU1; Diputación de Teruel, Teruel, DU2; DanBred, Axelborg, Copenhagen, DU3) were mated to 192 dams (4 for each sire line). The study was conducted at El Chantre (Diputación de Teruel) in two different batches, lasting from February 1999 to January 2000 and from October 2000 to September 2001, respectively. Since each sire line was mated to the same dam line (Landrace × Large White; LRXLW), the differences among the progeny of sire lines DU1, DU2 and DU3 used in this study represented one-half of the difference among the sire lines. All lines used in this study had been tested as free of the malignant hyperthermia gene.

Piglets were grouped by live weight and line; they were given ad libitum access to feed. When the mean pen weight reached 115 kg, two pigs were selected at random from each dam. A total of 133 pigs were selected from each sire line to be slaughtered for carcass and meat quality evaluation. Pigs remained in their test group until they were transported from the farm to slaughterhouse. All farms were located within 2 h transport to the abattoir. The 399 pigs rested in lairage pens approximately 12 h before slaughter with access to water. They were weighed immediately prior to slaughter and they were stunned with 92% carbon dioxide during 75 s. All the animals were slaughtered in four batches of about 100 pigs.

2.2. Measurement of carcass and meat quality

Carcass weight and fat and muscle depths, measured both at the last rib (l.r.) and between the 3rd and 4th last thoracic ribs counting from the last one (at 60 mm from the mid-line; 3–4 l.r.) using the Fat'o'meat'er probe (Gispert & Diestre, 1994), were recorded for each carcass within 1 h post-mortem (p.m.). The value of pH at 45 min p.m. was recorded in the *Longissimus thoracis* (last rib; pH45LT) and *Semimembranosus* (pH45SM) muscles. At 24 h p.m., the left side of the carcass was commercially cut and the main cuts (ham, loin, shoulder, belly, tenderloin and fat) were weighed to obtain cut percentages. Meat quality was assessed by measuring pH (pHuLT and pHuSM), using a portable meter with a xerolyte electrode, and electrical conductivity (PQM-I-INTEK, Gmbh, Germany; QMuLT; QMuSM) in LT and SM muscles. Objective muscle colour measurement was done using a Minolta Chromameter CR200 in the CIELAB space (Lightness, L^*; redness, a^*; and yellowness, b^*) in a transversal cut at the last rib level on the LT, and on a SM slice, after blooming for 5 min at 10 °C. Intramuscular fat content using Near Infrared Transmittance (NIT-Infratec 1265) was assessed in three muscles: LT (IMFLT), SM (IMFSM) and *Gluteus medius* (IMFGM) (Gispert, Valero, Oliver, & Diestre, 1997).

2.3. Dry-curing process

A total of 54 legs were randomly selected (18 legs/cross) among all left legs weighing 11.5–13.5 kg and having pH values $\leqslant$6.0. They were processed according to the specifications of Designation of Origin (D.O.) Teruel (Boletín Oficial del Estado, 1993) for a total dry-curing time of 12 months. An assessment for the qualification of hams was brought about by the Regulatory Council of D.O. Teruel; the final approved samples were 15 dry-cured hams from DU1, 18 from DU2 and 16 from DU3 sire lines. All hams had a final weight of 8.5–9.5 kg.

2.4. Analytical methods on dry-cured ham

Cured hams were deboned. The ham portion including *Biceps femoris*, *Semimembranosus* and *Semitendinosus* muscles was evaluated for instrumental texture and colour, biochemical and sensory analyses and acceptability

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