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POSTER

# Carcass and meat traits of different Iberian pig genotypes fed in a traditional extensive system

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## SUMMARY

Carcass composition and meat quality traits of three different genotypes of pure Iberian pig, i.e., Retinto (R), Torbiscal (T) and Torbiscal*Retinto (TR), as well as a Duroc*Retinto (DR) crossbred, were evaluated. A total of 48 pigs, 12 of each genotype, were used. Thickness of back fat (BF) depots, namely inner (i), middle (m), outer (o) and total (t), measured at the 10th and 14th rib levels (iBF10, mBF10, oBF10, tBF10, iBF14, mBF14, oBF14 and tBF14, respectively), were determined in the carcass. Loin area (LA) at the 10th and 14th rib levels (LA10 and LA14, respectively) were measured with a planimeter, and percent intramuscular fat (IMF) was chemically analysed. Weights (W) and yields (Y) of prime meat cuts, namely ham (H), foreleg (F), loin (L), and tenderloin (TL) were recorded (HW, FW, LW, TLW and HY, FY and LY, respectively), and total prime cut weight (TCW) and yield (TCY) were calculated. Since the DR genotype grew faster than expected, these had to be finished on concentrate and, consequently, not all meat quality traits were analysed, as they are affected by feeding system. Therefore, DR pigs were used only for carcass traits comparisons. Data were analysed by using the GLM procedures in SAS with carcass weight (within genotype) as a covariate. In relation to fat deposition traits, the R genotype had significantly greater IMF, IBF10, MBF10 and TBF10 than the other genotypes, and the T genotype had significantly greater OBF10 and OBF14 than the other genotypes. In relation to meat deposition, HW and HY were equal for all genotypes, but TR and DR genotypes had heavier forelegs and loins than R and T genotypes. Among pure Iberian genotypes, TR had larger prime cut weights and yields than R but similar to T. On the other hand, DR had the largest TCW and TCY.

**Estudios de caracteres de canal y carne de diferentes genotipos de cerdo Ibérico alimentados en un sistema tradicional extensivo**

Palabras clave adicionales
Líneas de porcino.
Finalizados con bellota.
Caracteres de canal y carne.
Deposición grasa.

## RESUMEN

Caracteres de la canal y calidad de carne de tres genotipos distintos de ibérico puro, Retinto (R), Torbiscal (T) y Torbiscal*Retinto (TR), y un cruce de Duroc*Retinto (DR) han sido estudiados. Se han utilizado 48 cerdos, 12 por genotipo. El espesor de los diferentes depósitos de la grasa dorsal: interno (i), medio (m), externo (o) y total (t), medidos a nivel de la décima y decimo cuarta costilla (iBF10, mBF10, oBF10, tBF10, iBF14, mBF14, oBF14 y tBF14, respectivamente) se midieron en la canal así como el área del lomo (LA10 y LA14, respectivamente) y el porcentaje de grasa intramuscular (IMF) se determinó químicamente. Los pesos (W) y rendimientos (Y) de las piezas más importantes: jamón (H), paleta (F), lomo (L), y solomillo (TL) se recogieron (HW, FW, LW, TLW y HY, FY y LY, respectivamente). Los pesos y rendimientos de todas las piezas se calculó también (TCW y TCY). Como el genotipo DR creció más rápido de lo esperado, estos animales se finalizaron con un concentrado y no con bellota como los otros tres genotipos. Así, el genotipo DR solo se compara para caracteres de canal. Los datos se analizaron utilizando el procedimiento GLM de SAS, ajustando por el peso de canal dentro de cada genotipo como covariable. Como resultados el genotipo R tuvo valores de IMF, IBF10, MBF10 y TBF10, significativamente mayores que los otros genotipos y el genotipo T tuvo valores significativamente mayores que los otros genotipos para OBF10 y OBF14. Además, HW y HY obtuvieron valores semejantes para todos los genotipos, pero TR y DT obtuvieron paletas y lomos más pesados que los genotipos R y T. Dentro de los genotipos ibéricos puros TR obtuvo mejores TCW y TCY que R pero igual que T. Por otro lado, el genotipo DR fue el que obtuvo los mejores valores para TCW y TCY.

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## INTRODUCTION

The Iberian breed is composed of several differentiated lines that show an important degree of variability (Juárez et al. 2009, p. 1573). Not many studies have been reported on the performances of these lines, but Benito et al. (2000) and Ibáñez-Escriche et al. (2014, p. 1569) described the Torbiscal line as a strain characterized by faster growth and better carcass performances than the Retinto and Lampiño lines. As a common practice, the Retinto line is crossed with the Duroc breed to produce an F1 crossbred that exhibits faster growth and superior meat yields than the pure Iberian breed and, in contrast, is usually raised in in-

tensive production systems (López-Bote, 1998, p. 17). The Iberian meat production is regulated by a specific regulation "*Norma de Calidad del Cerdo Ibérico*"; that describes the age and weight requirements according to the feeding and rearing system (concentrate-outdoors and acorn-outdoors). Although few studies have evaluated the performances and the possible heterosis and complementarity effects of the crosses among different Iberian strains (Ibáñez-Escriche et al. 2016, p. 28), almost none of them studied animals finished in the extensive (free-ranging) acorn system. For this reason, the aim of this study was to evaluate the carcass and meat quality traits of a cross between Torbiscal as sire line and Retinto as maternal line in comparison to the performances of the pure lines (T and R) in extensive acorn-feeding production systems.

## MATERIAL AND METHODS

### Animals and experimental procedures

For this study, 48 immunocastrated males were used (12 R, 12 T, 12 T*R and 12 D*R). After weaning, piglets were located outdoors in a big corral and were fed with concentrate according to age until they were 10 months old. At this age, D*R pigs were located in a separate corral and fed concentrate *ad libitum*, as usually done in commercial piggeries. The pure Iberian genotypes remained together and were fed on a maintenance diet until 12 months of age. At this age, pigs were finished with acorns in a traditional "*montanera*" system for 2 to 3 months. When slaughter weight was reached, D*R genotype was slaughtered at 12 months of age, and pure Iberian genotypes were slaughtered at 14-16 months of age.

### Carcass and meat traits

Before slaughtering, animals were weighed, and then carcass and prime cuts (ham, foreleg, loin, and tenderloin) were weighed at the packing plant. In addition, the thickness of the three back fat layers and the loin area at the 10$^{th}$ and 14$^{th}$ rib levels were measured. Meat colour (Minolta©), and 45-minute and 24-hour Ph were recorded. In addition, samples were taken at the 10$^{th}$ to 14$^{th}$ rib level to evaluate the percent intramuscular fat, meat tenderness and cooking loses.

### Statistical analysis

Data was analysed using the Generalized Linear Models (GLM) in SAS, with a model including the effect of genotype and the carcass weight within genotype included as a covariate. Means were compared by using the test of Least Significant Differences (LSD). Least squared means and standard errors are presented in the present article.

## RESULTS

**Tables I** and **II** depict the differences among genotypes for prime cut weights and yields. In general, prime cuts were heavier for the DR genotypes than for the other genotypes, but regarding the hams, there were no differences in HW and HY among genotypes. With respect to the other prime cut weights and yields, the Retinto genotype had the smallest LW, LY, TLW and TCW. In relation to pure Iberian genotypes, T and TR genotypes were similar for all characters except for FY, the R genotype was similar to T (except for LW and LY), and the R and TR genotypes were different for LW, TLW and TCW.

Results in **Table III** and **IV** indicate that oBF10 and oBF14 were larger for T genotype than for the other genotypes, and also that R genotype had thicker mBF10, tBF10, iBF14 mBF14, tBF14 and IMF than the other genotypes. The TR genotype had a significantly smallest tBF14 than the T and R genotypes, thus indicating a possible heterosis effect. In relation to the remaining meat quality traits, the T genotype had significantly more pink meat than the R and TR genotypes. In addition, the T and TR genotypes had larger LA14 and greater cooking loses (**CL**) than the R genotype, and the T genotype had larger LA10 than the R genotype. Not differences among genotypes were found for 45- and 24-hours Ph.

## DISCUSSION

The DR genotypes were not evaluated for meat quality parameters since they were fed on concentrate, and, as expected, they were in general superior than the pure Iberian genotypes for carcass composition traits. Therefore, this discussion will be focussed on comparisons among the pure Iberian genotypes. Pre-

**Table I.Means and standard errors of prime cut weights of the different Iberian genotypes, Torbiscal (T), Retinto (R), Torbiscal*Retinto (TR) and Duroc*Retinto (DR)** (Medias y errores estándar de los pesos de las principales piezas de los diferentes genotipos de Ibérico, Torbiscal (T), Retinto (R), Torbiscal*Retinto (TR) y Duroc*Retinto (DR).

| | T | | R | | TR | | DR | |
|---|---|---|---|---|---|---|---|---|
| Variables* | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| SW(Kg) | 183.83$^{b}$ | 3.5 | 174.83$^{c}$ | 4.03 | 178.71$^{bc}$ | 3.5 | 202.34$^{a}$ | 3.35 |
| CW(Kg) | 148.8$^{b}$ | 2.86 | 141.1$^{c}$ | 3.3 | 145.36$^{bc}$ | 2.65 | 159.8$^{a}$ | 2.75 |
| HW(Kg) | 16.02 | 0.18 | 15.9 | 0.29 | 15.9 | 0.17 | 15.94 | 0.25 |
| FW(Kg) | 11.5$^{c}$ | 0.19 | 11.6$^{ac}$ | 0.31 | 12.15$^{a}$ | 0.19 | 12.9$^{b}$ | 0.27 |
| LW(Kg) | 2.1$^{a}$ | 0.06 | 1.6$^{b}$ | 0.10 | 2.18$^{a}$ | 0.06 | 2.66$^{c}$ | 0.09 |
| TCW(Kg) | 59.3$^{bc}$ | 0.63 | 58.21$^{b}$ | 1.03 | 60.5$^{c}$ | 0.62 | 63.03$^{a}$ | 0.9 |
| TIW(Kg) | 0.38$^{bc}$ | 0.01 | 0.35$^{b}$ | 0.02 | 0.41$^{c}$ | 0.01 | 0.48$^{a}$ | 0.02 |

*Slaughter weight (SW), carcass weight (CW), Ham weight (HW), Foreleg weight (FW), loin weight(LW), total cuts weight (TCW) and Tenderloin weight (TLW). Means with different superscript letters are signi icantly different (P<0.05).

**Table II.** Means and standard errors of prime cut yields of the different Iberian genotypes, Torbiscal (T), Retinto (R), Torbiscal*Retinto (TR) and Duroc*Retinto (DR) (Medias y errores estándar de los rendimientos de las principales piezas de los diferentes genotipos de Ibérico, Torbiscal (T), Retinto (R), Torbiscal*Retinto (TR) y Duroc*Retinto (DR)).

| | T | | R | | TR | | DR | |
|---|---|---|---|---|---|---|---|---|
| Variables* | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| CY (%) | 0.81 | 0.004 | 0.81 | 0.005 | 0.81 | 0.004 | 0.79$^{a}$ | 0.004 |
| HY(%) | 0.215 | 0.002 | 0.212 | 0.002 | 0.214 | 0.002 | 0.215 | 0.002 |
| FY(%) | 0.15$^{b}$ | 0.002 | 0.15$^{b}$ | 0.003 | 0.16$^{c}$ | 0.002 | 0.17$^{a}$ | 0.002 |
| LY(%) | 0.028 | 0.0008 | 0.023$^{b}$ | 0.0009 | 0.0293 | 0.0008 | 0.036$^{a}$ | 0.0008 |
| TCY(%) | 0.40$^{bc}$ | 0.004 | 0.39$^{c}$ | 0.005 | 0.405$^{b}$ | 0.004 | 0.429$^{a}$ | 0.004 |

*Carcass Yield (CY), Ham yield (HY), Foreleg yield (FY), Loin yield (LY),Total Cut yield (TCY). Means with different superscript letters are significantly different (P<0.05).

**Table III.** Means and standard errors of fat thickness layers at different levels of the different Iberian genotypes, Torbiscal (T), Retinto (R), Torbiscal*Retinto (TR) and Duroc*Retinto (DR) (Medias y erróres estándar de las diferentes capas de espesor de grasa subcutánea de los diferentes genotipos de ibérico Torbiscal (T), Retinto (R), Torbiscal*Retinto (TR) and Duroc*Retinto (DR)).

| | T | | R | | TR | | DR | |
|---|---|---|---|---|---|---|---|---|
| Variables* | Mean | SE | Mean | SE | Mean | SE | Mean | SE |
| iBF10 (cm) | 2.07 | 0.15 | 2.54 | 0.25 | 2.15 | 0.15 | 2.34 | 0.22 |
| mBF10(cm) | 5.2$^{b}$ | 0.2 | 6.09$^{c}$ | 0.33 | 4.76$^{b}$ | 0.19 | 4.07$^{a}$ | 0.28 |
| oBF10(cm) | 2.35$^{a}$ | 0.07 | 2.07 | 0.12 | 2.09 | 0.07 | 2.09 | 0.11 |
| tBF10(cm) | 9.62$^{c}$ | 0.28 | 10.7$^{a}$ | 0.46 | 9.0$^{bc}$ | 0.27 | 8.5$^{b}$ | 0.4 |
| iBF14(cm) | 1.9 | 0.09 | 2.53$^{a}$ | 0.15 | 1.98 | 0.09 | 1.91 | 0.13 |
| mBF14(cm) | 3.02$^{c}$ | 0.12 | 3.8$^{a}$ | 0.19 | 2.8$^{c}$ | 0.11 | 2.23$^{b}$ | 0.17 |
| oBF14(cm) | 1.67$^{a}$ | 0.06 | 1.40$^{b}$ | 0.10 | 1.40$^{b}$ | 0.06 | 1.52$^{ba}$ | 0.08 |
| tBF14(cm) | 6.61$^{a}$ | 0.17 | 7.74$^{b}$ | 0.27 | 6.19$^{c}$ | 0.16 | 5.66$^{d}$ | 0.24 |
| LA10 ($cm^2$) | 26.7$^{a}$ | 1.0 | 23.16$^{b}$ | 1.22 | 25.14$^{ab}$ | 0.93 | | |
| LA14($cm^2$) | 30.46 | 1.34 | 20.37$^{a}$ | 1.63 | 29.29 | 1.25 | | |

*Thickness of back fat depots, namely inner (iBF10; iBF14), middle (mBF10;mBF14), outer (oBF10; oBF14), and total (tBF10; tBF14) at the 10$^{th}$ and 14$^{th}$ (last) rib level; and loin area at the 10$^{th}$ and 14th rib level (LA10, LA14). Means with different superscript letters are significantly different (P<0.05).

vious studies (Ibañez-Escriche et al. 2014, p. 1569) indicated significant heterosis for HW, FW and LW, being in general the TR genotype significantly superior than the R and T genotypes for these traits. In our present study, no significant differences were obtained for any of these traits between T and TR genotypes. However, FY was significantly larger for TR than for T and R genotypes, and therefore heterosis may be expected for this trait. In relation to fat traits in our study, TBF14 was significantly lower for TR compared with T and R genotypes, but Ibañez-Escriche et al. (2016, p. 28) did not find significant heterosis effects for back fat, measured at the fourth rib level in a concentrate-feeding system. These authors also reported a significant (trend; P<0.1) heterosis effect for IMF in the loin for the TR crossbred. In our study, no significant differences were found for IMF between TR and T genotypes. However, IMF was larger for R than for T genotype, in agreement with results reported by Ibañez-Escriche et al. (2016, p. 28). Different results were obtained by Benito et al. (2000, p. 113), who reported no significant differences in ham fat IMF among the three genotypes fed on acorn, but in that study slaughter weight was significantly lower for the R line (143 *vs* 155 and 157

**Table IV.** Means and standard errors of several meat quality traits of the different Iberian genotypes, Torbiscal (T), Retinto (R) and Torbiscal*Retinto (TR) (Medias y errores estándar de varios caracteres de carne de los diferentes genotipos de Ibérico, Torbiscal (T), Retinto (R), Torbiscal*Retinto (TR) y Duroc*Retinto (DR)).

| Variables* | T | | R | | TR | |
|---|---|---|---|---|---|---|
| | Mean | SE | Mean | SE | Mean | SE |
| WB | 5.0 | 0.33 | 4.91 | 0.4 | 5.46 | 0.3 |
| L* | 37.4 | 0.86 | 37.13 | 1.05 | 37.23 | 0.8 |
| a* | 6.95$^{a}$ | 0.40 | 7.72$^{ab}$ | 0.48 | 8.50$^{b}$ | 0.37 |
| b* | 1.64 | 0.26 | 2.03 | 0.31 | 2.15 | 0.24 |
| IMF(%) | 6.09 | 0.62 | 8.05$^{a}$ | 0.75 | 6.3 | 0.57 |
| CL (g.) | 13.87$^{a}$ | 0.59 | 11.89$^{b}$ | 0.72 | 13.22$^{ab}$ | 0.55 |

* Warner Blazer (WB), Luminosity index (L*), Red index (a*), Yellow index (b*), Percent Intramuscular Fat (IMF) and Cooking looses (CL). Means with different superscript letters are significantly different (P<0.05).

for T and TR, respectively). Therefore, results may vary substantially according to the feeding system, the slaughter weight and the anatomical location of the measurements, so these aspects need to be considered when comparing results.

## CONCLUSION

The T*R genotype produced animals with heavier forelegs and loins than R and T genotypes and leaner pigs than R genotypes. Therefore, crossing Iberian lines may improve carcass performances of pure Iberian pigs.

## ACKOWLEGMENTS

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