EFFECTS OF RACTOPAMINE ADMINISTRATION AND CASTRATION METHOD ON THE CARCASS AND MEAT QUALITY IN PIGS OF TWO PIÉTRAIN GENOTYPES

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Abstract

The objective of this study was to evaluate the effects of ractopamine supplementation, castration method, and their interaction on the carcass and meat quality of 2 Piétrain genotypes. A total of 1,488 male pigs (115 ± 5 kg BW) were distributed according to a 2 × 2 × 2 factorial arrangement of treatments. The first factor was ractopamine supplementation with 2 groups of pigs (376 and 380 pigs each) receiving 7.5 mg/kg of ractopamine (RAC) or not (NRAC) in their diet during the last 28 d of the finishing period. The second factor was castration method, with 744 surgical castrates (SC) and 744 immunized males (IM), and the third factor was the genotype with 2 crossbreeds containing 50% (genotype A, GA; n = 744) or 25% (genotype B, GB; n = 744) Piétrain genetics. Dressing yield was greater ($P = 0.01$) in RAC and SC-GB pigs. Carcasses from RAC pigs and IM were leaner than those from NRAC and SC pigs ($P < 0.001$ and $P = 0.002$, respectively). Feeding RAC to IM increased drip loss in the LM ($P = 0.05$). Warner-Bratzler shear force values were slightly greater in the LM from RAC-GB pigs and from IM compared with SC ($P = 0.01$ and $P < 0.001$, respectively) and in the semimembranosus muscle of RAC pigs ($P = 0.006$). In conclusion, immunization against GnRF more than the use of Piétrain genotypes appears to be a viable alternative to the use of ractopamine.

Key words: meat quality, pigs, ractopamine

Introduction

Ractopamine (RAC) is a β-adrenergic agonist that, when fed to pigs, increases growth rate and carcass leanness and produces acceptable pork quality. However, despite the advantages, in terms ofgrowth rate and lean yield, there is evidence that feeding pigs with ractopamine (RAC) makes pigs more susceptible to stress and more aggressive. The use of high-lean growth potential genotypes, such as Halothane-free Piétrain pigs or mmunized-males may allow producers to have the same performances as RAC-fed pigs at no detriment on animal welfare and meat quality. Therefore, the objective of this study was to evaluate the effects of RAC administration, Piétrain genotype, and immunization against GnRF as single factors or in interaction on carcass and meat quality in pigs.

Material and Methods

Animals and treatments

A total of 1,488 pigs (115 ± 5 kg BW) were distributed according to a 2 × 2 × 2 factorial arrangement of treatments. The first factor was RAC supplementation (Paylean; Elanco Animal Health, Guelph, Canada) with 2 groups of pigs (744 pigs each) receiving 7.5 mg/kg of RAC or not (NRAC) in the diet during the last 28 d of the finishing period. The second factor was castration method with 744 surgical castrates (SC) and 744 IM, and the third factor was the genotype with 2 crossbreeds containing 25% (genotype A, GA; n = 744) or 50% (genotype B, GB; n = 744) of Piétrain genetics. Piétrain sire lines were free of the halothane gene (HalN). Surgical castration took place at 2 d of age, whereas immunization against GnRF was performed through 2 subcutaneous injections (2 mL per animal) of GnRF analog (Improvest; Pfizer Animal Health) at 10 and 4 wk before slaughter.

Carcass Quality Measurements

After slaughter, carcasses were eviscerated, split, and chilled according to standard commercial practices. Hot carcass weight and carcass lean percentage were recorded, and HCW was used to calculate dressing percentage.

Meat quality measurements

Meat quality was assessed on 336 carcasses (7/ group) by measuring pH at 24 h post-mortem in the longissimus muscle (LM) and in the semimembranosus (SM) using a pH meter. At 24-h post-mortem, the following measurements were also taken in the LM and SM muscles: light reflectance by a Minolta Chromameter CR 300 according to the reflectance coordinates (CIE L*, a*, b*) and subjective color score with the Japanese Color Standards (from 1 = pale to 6 = dark color; Nakai *et al.*, 1975) after exposing the muscle surface to 30-min blooming time. A LM and SM muscles chops (10-20 cm in length) were taken at the ¾ last rib level for the assessment of drip loss at 48 h post-mortem as described by a modified EZ-Driploss procedure (Correa *et al.*, 2007), Warner-Bratzler ND shear force (WBSF) and myofibrillar fragmentation index (MFI).

Statistical Analysis

The MIXED procedure of SAS was applied to analyse carcass and meat quality data using the experimental individual animal as the experimental unit. Comparisons between treatment means were adjusted for multiple comparisons with a Tukey-Kramer correction. A probability level of $P < 0.05$ was chosen as the limit for statistical significance in all tests, whereas probability levels of $P \leq 0.10$ were considered to be a tendency.

Results and Discussion

Carcass Quality Traits

Compared to NRAC pigs, RAC dietary supplementation increased HCW (93.08 ± 0.40 vs. 91.65 ± 0.40), dressing yield (79.75 ± 0.20 vs. 79.17± 0.20) and carcass leanness (63.13 ± 0.19 vs. 62.48 ± 0.19; Table 1). The greater carcass yield can be explained by the increased lean tissue deposition in the carcass of RAC supplemented animals compared to the growth of organs and viscera. The increased lean yield may be explained by the effect of RAC on repartitioning of nutrients to lean and away from the adipose tissue. In this study SC carcasses were heavier than IM carcasses, especially in B pigs (P = 0.005). A greater (P = 0.01) dressing yield were also found in SC B-SC carcasses compared to IM in B pigs. The lower dressing percent in IM compared to SC was considered to be mostly due to larger guts and to the presence of testes and associated tissue, bulbo-urethral glands, seminal vesicles and a thicker skin. Thus, the additive effect of the Piétrain genotype on SC carcass traits is not surprising.

Consistently with previous reports carcasses from IM were leaner (P = 0.002) than SC pigs (63.08±0.2 vs. 62.5±0.2) indicating that immunization against GnRF can still deliver the carcass quality attributes of boars to producers.

Meat Quality

Meat quality variation was mostly influenced by RAC feeding alone or in combination with castration method and Piétrain genotype in this study (Table 2). Compared to RAC pigs, the LM muscle of NRAC pigs were slightly paler (higher L* value; 51.6±0.5 vs. 50.7 ± 0.5). Results on the effects of RAC on pork lightness (L* value) are conflicting, with some studies either showing paler loins in RAC pigs (Leick *et al.*, 2011) or showing no effect (Stoller *et al.*, 2003; Patience *et al.*, 2009; Kutzler *et al.*, 2011). RAC feeding decreased drip loss in LM (3.3±0.3 vs. 3.8±0.3) and increased WBSF values in B loins (P =0.01) and in the SM muscle (P = 0.006). The lower drip loss in RAC loins may be related to the effects of RAC feeding on the reduced fat deposition and increased protein deposition, resulting in higher water retention (Crome *et al.*, 1996). Based on the relationship between WBSF and MFI (LM: r = - 0.53; SM: r = - 0.49) in this study, the greater toughness of pork from RAC pigs may be explained by the effects of RAC dietary supplementation on the reduced post-mortem ageing process (lower MFI; P < 0.001). To our knowledge, this study provides the first evidence about the negative effect of RAC feeding on pork tenderness in pigs of Piétrain genetics.

Minor effects of immunization against GnRF on pork quality were found in this study. Compared to SC, WBSF values were slightly greater (P = 0.01) in the LM (3.0±0.05 vs. 3.2±0.05) and tended to be greater (P = 0.06) in the SM muscle of IM (3.9±0.1 vs. 4.1±0.1). Both the increased water exudation and toughness in pork evaluated in this study may be explained by the greater proportion of glycolytic fibers and larger fiber size in the muscles of leaner pigs, such as IM in this study. Apart from the afore-mentioned slight increase in drip loss, RAC dietary supplementation had no major additive effect on pork quality variation in immunized males in this study.

Conclusions

The ractopamine administration benefited the carcass leanness, whereas in terms of meat quality variation, the major effects were found on drip loss and toughness. However, given the small magnitude of the difference between treatments, water exudation found in pork meat in this study cannot be considered of economic importance for the processing industry and the between-treatments variation in WBSF values is less than 1 kg which is the threshold value for the average consumer detection of meat toughness. Thus, based on the results arising from the present study, immunization against GnRF more than the use of Piétrain genetics appears to be a viable alternative to the use of ractopamine as it ensures the production of lean carcasses without any major effect on pork quality.

Table 1. Effects of ractopamine supplementation, castration method and Piétrain genetics on carcass characteristics[1]

	RAC				NRAC				SEM	*P values*			
	SC		IM		SC		IM			RAC	CAS	GEN	CAS*GEN
Genotype	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**					
HCW, kg	92.6	94.4	92.6	92.6	91.5	94.0	91.0	90.1	0.66	0.001	0.0008	0.06	0.005
Dressing yield,%	80.1	81.2	78.8	78.9	79.2	81.1	78.0	78.5	0.34	0.01	< .0001	0.0001	0.01
Lean yield,%	62.9	62.6	63.3	63.7	62.5	62.1	62.9	62.4	0.28	0.0004	0.002	NS	NS

Table 2. Effects of ractopamine supplementation (RAC), castration method (CAS) and Piétrain genotype (GEN) on meat quality characteristics [1]

	RAC				NRAC					*P values*					
	SC		IM		SC		IM		SEM	RAC	CAS	GEN	RAC*CAS	RAC*GEN	CAS*GEN*RAC
Genotype	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**							
LM															
pH_u	5.8	5.7	5.8	5.7	5.7	5.7	5.7	5.7	0.03	NS	NS	0.04	NS	NS	NS
L*	50.7	50.7	50.7	50.9	51.3	52.3	51.4	51.6	0.63	0.007	NS	NS	NS	NS	NS
Drip loss, %	2.9	2.9	3.9	3.5	3.5	4.0	3.7	4.0	0.40	0.02	0.03	NS	NS	NS	NS
WBSF[2], kg	2.9	3.4	2.9	3.6	2.7	2.9	3.0	3.2	0.11	0.001	0.01	<.0001	NS	0.01	NS
MFI3	64.0	64.3	63.5	58.8	78.2	74.1	69.9	66.7	4.68	<.0001	0.02	NS	NS	NS	NS
SM muscle															
pHu	5.8	5.9	5.9	5.8	5.8	5.7	5.8	5.8	0.03	NS	NS	NS	NS	NS	NS
L*	48.2	47.2	47.3	48.4	48.0	48.3	47.7	47.3	0.48	NS	NS	NS	NS	NS	0.04
Drip loss, %	2.6	2.7	2.8	3.5	2.4	3.3	3.1	3.0	0.3	NS	NS	0.07	NS	NS	NS
WBSF, kg	4.1	4.2	4.2	4.3	3.5	3.7	3.9	3.9	0.017	0.006	0.06	NS	NS	NS	NS
MFI[3]	47.9	43.2	52.8	45.4	62.1	64.1	53.7	51.0	7.74	0.002	NS	NS	0.02	NS	NS

[1]RAC: with ractopamine, NRAC: without ractopamine; SC: surgically castrates, IM: immunized males; A = 25% Piétrain, B = 50% Piétrain
[2]WBSF: Warner-Bratzler shear force
[3]MFI: myofibrillar fragmentation index