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Immunological castration of swine improves performance, cutting yields and leanness

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Introduction

Meat market requires high nutritional value products with low fat content, suitable tenderness and attractiveness to the most selective consumers. The challenge also includes meat production within the ethical principles of animal welfare at an affordable price and a profitable return. An immunocastrated pig is a boar immunized against gonadotrophin-releasing factor (GnRF). This practice is an important available technology to achieve these goals.

Both surgical castration and immunocastration are necessary practices to control boar taint in pork, which is highly undesirable to consumers and caused mainly by androstenone pheromone and skatole (MEIER-DINKEL et al., 2013). Surgical castration has recently been questioned by both governmental authorities and animal welfare groups, because castration is practiced without anesthesia, which is potentially painful for piglets (AASLYNG et al., 2016). Immunization against GnRF inhibits testicular function, improves growth and carcass quality, and additionally reduces stress compared to surgical castration (RIKARD-BELL et al., 2009). Despite the positive effect of immunocastration, the cost of this technology includes investment and training handlers.

In this scenario, immunocastration benefits can be economically viable, because pigs perform as intact males until the second vaccination (ASMUS et al., 2014), altering feed intake and tissue deposition thereafter (DUNSHEA et al., 2013). Moreover, immunocastration improves performance and carcass characteristics (LOWE et al., 2014). Therefore, the objective of this study was to evaluate the effects of immunocastration of pigs on animal performance and carcass quality.

Material and Methods

Animals, Housing, and Handling

The experiment was conducted in a commercial farm, located in the Central Region of Rio Grande do Sul State, Brazil. Male piglets (Camborough 25 x AGPIC 337) were selected and assigned to treatments based on birth weight at farrowing house. Births occurred within the same week and weaning was at the 3rd week of life.

Surgical castration was performed in half of littermates on the 7th day of life whereas the remaining animals were immunocastrated through two vaccinations at days 98th and 133rd of age using a safety vaccination gun at a dose of 2 mL of Vivax® (Zoetis Brazil) behind and below the ear base.

At weaning, 160 piglets were split: 80 castrated and 80 entire males. They were weighed and transferred to a single nursery and allotted by castration category to 16 pens of 10 pigs. These animals had average birth and weaning weights of 1.56 ± 0.26 kg and 6.55 ± 0.12, respectively. At 63 d of age, all pigs were weighed again and transferred to a growing-finishing facility (16 pens x 10 animals = 160).

All animals had free access to water and feed (commercial diets). Antimicrobials were added as growth promoters and the treatment of possible sanitary problems was done individually in the diseased animals. Ractopamine was added to the diet, at 5 mg/kg, along the last four weeks before slaughter.

Performance evaluation, Pre-Slaughter, and Slaughter handling

Pig performance was evaluated at the initial phase (0 to 21 days), at nursery (21 to 63 days), at growing phase (63 to 98 days), part of finishing phase (98 to 133 days), and at the end of finishing phase (133 to 161 days). The variables average daily gain (ADG), average daily feed intake (ADFI) and feed conversion (FC) were taken into account.

Feed withdrawal of 4 h was made before pigs were weighed and transported to the packing plant. Animals were held in pens for 6 h before being electrically stunned, exsanguinated from major blood vessels near the heart, and processed according to industry-accepted procedures.

Carcass trait evaluation

Hot carcasses from all pigs were weighed and optical probed (Hennessy Grading System - GP4 / BP4) across 6 cm insertion on median dorsal line of the carcass, between the last and penultimate rib in order to measure the backfat thickness (BF) and *Longissimus dorsi* (LD) depth. These variables and hot carcass weight (HCW) were used to estimate the lean meat percentage (LMP) through the equation LMP = 58.408 – (0.5886 * BF) + (0.1739 * LD depth) – (0.0189 * HCW). For each cut, carcass yield was expressed as g 100 g^{-1} of HCW, dividing the corresponding cut by the live weight at slaughter. Testis (without epididymis) were removed, identified, cleaned (removing surface fat), and weighed.

Carcass cutting yield

After a 24 h of slaughter, one animal from each pen was selected based on the closest weight to pen average in order to have cuts evaluated through carcass dissection, each part conducted by the same worker. Carcass left side was divided into commercial cuts that included ham and its parts, boston butt, picnic shoulder, shoulder butt, loin, belly and ribs, feet, tail and filet. Cuts were manually dissected and weighted. These procedures were performed by the same person who was blinded to the treatment assignment.

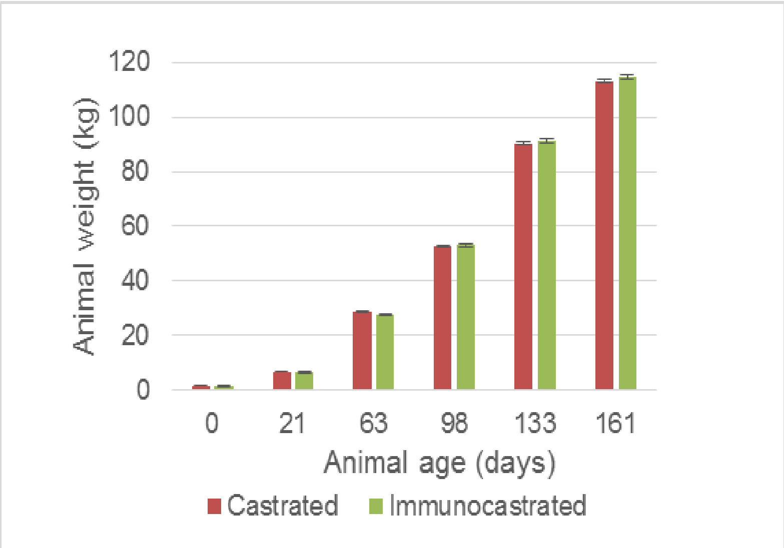
Statistical analysis

A randomized complete block design (RCBD), with two treatments (surgical castration and immunocastration) with eight replications per combination of main factors. Means were compared by F test after running PROC MIXED procedure (SAS INSTITUTE INC, 2012). To determine if two sets of data were significantly different from each other, means were compared using Student's t-test. Differences were considered significant at the level of $p < 0.05$.

Results and Discussion

The results in Graph 1 show the means ± standard error, comparing castration and immunocastration regarding animal weight (kg) along the experiment.

Graph 1 – Animal weight from birth to slaughter



Although birth and weaning weights were different (p=0.02 and p=0.07, respectively) between treatments, no differences were observed for this variable in later periods (p>0.10), all animals had the same weight (p=0.02). At 21 days of animal age, slight change (p=0.07) was observed in animal weight among animals submitted to castration (6.60±0.068 kg) and immunocastration (6.49±0.059 kg). From 63 days on, animal weight differed slightly (p>0.05).

Regarding ADG, only from 63 to 133 days of age, difference (p=0.002) was observed. All the other ADG remained similar, in the range from 249 to 1086 g on average comparing the first and last measure weight. The ADFI tended to differ (p=0.06) in the last period of animal life, from 133 to 161 days of age (3.014±0.056 kg day^{-1}) and differed (p=0.05) when comparing the last with the first measurement, from 21 to 161 days of age (1.740±0.010 kg day^{-1}). FC tended to be better (p=0.07) when immunocastration was applied (FC = 2.091±0.029) from 63 to 133 days of animal age, when compared to castrated animals (FC = 2.145±0.026).

Overall, immunocastration did not affect performance parameters. Similar findings were observed for other immunocastrated species. For instance, Machado et al. (2018), performed a meta-analyses evaluating the effects of immunocastration on the performance and carcass quality of steers in the finishing phase, compared with non-castration and surgical castration. They verified that non-castrated steers had greater ADG, FC, slaughter weight, hot carcass weight, and loin eye area than castrated animals. Immunocastrated steers present greater slaughter weight, hot carcass weight, and loin eye area than surgically-castrated animals. The meat of steers subjected to surgical or immunological castration presented greater subcutaneous fat depth and better coloring, but greater losses during thawing.

Table 1 shows the carcass traits and yields of castrated and immunocastrated animals along the experiment.

Table 1 – Carcass traits and cut yields

Variable	N	Castrated	N	Immunocastrated	*p*
Testis weight (kg)	-	-	79	0.48 ± 0.015	-
Carcass yield (%)	77	0.77 ± 0.003	79	0.76 ± 0.009	0.01
Backfat (mm) [1]	77	15.58 ± 0.359	79	13.02 ± 0.310	0.0003
Loin depth (mm) [1]	77	63.68 ± 0.752	79	62.95 ±0.759	0.05
Carcass weight (kg) [1]	77	87.58 ± 0.619	79	86.70 ± 0.750	0.46
Leanness (%) [1]	77	58.13 ± 0.258	79	59.57 ± 0.220	0.0005
Leanness (%) [2]	77	58.66 ± 0.268	79	60.05 ± 0.229	0.0006
Pork cut yield					
Ham (kg)	8	13.62 ± 0.108	8	13.36 ± 0.169	0.16
Ham lean meat (kg)	8	8.87 ± 0.182	8	9.04 ± 0.163	0.58
Ham skin and fat (kg)	8	2.74 ± 0.163	8	2.21 ± 0.087	0.02
Ham retail (kg)	8	0.81 ± 0.060	8	0.84 ± 0.053	0.71
Ham bones (kg)	8	1.18 ± 0.018	8	1.28 ± 0.042	0.08
Boston butt and picnic shoulder (kg)	8	8.47 ± 0.120	8	8.64 ± 0.133	0.46
Boneless shoulder butt (kg)	8	3.48 ± 0.070	8	4.05 ± 0.126	0.007
Loin roast (kg)	8	6.33 ± 0.092	8	6.35 ± 0.217	0.96
Belly and ribs (kg)	8	7.49 ± 0.197	8	8.06 ± 0.294	0.03
Feet, tail and filet (kg)	8	1.45 ± 0.028	8	1.39 ± 0.026	0.11

[1] Results based on carcass grading with an electronic pistol

[2] Leanness estimated according to Embrapa formula (Material and Methods: Carcass trait evaluation)

Most of the variables related to fat and lean meat were significantly different ($p<0.05$) between castrated and immunocastrated animals. The carcass yield, backfat, loin depth decreased ($p<0.05$) in immunocastrated animals, while leanness increased in immunocastrated pigs, despite of the formula used to calculate this variable. Carcass weight had no difference ($p>0.05$) between the groups. Regarding pork cut yields, ham skin and fat decreased, while boneless shoulder butt and belly and ribs had greater values in immunocastrated animals and these were the only variables that showed significant difference ($p<0.05$) among the studied groups.

Dalla Costa et al. (2018) evaluated immunocastration in pigs on diverse parameters and also its association to ractopamine. They observed that immunocastration alone significantly differed ($p<0.05$) from physically castrated pigs regarding ham fat, belly lean meat, belly fat, shoulder lean meat and shoulder fat, corroborating our findings herein. In all the mentioned variables, lean meat was increased and fat decreased when comparing immunocastrated and physically castrated pigs.

This decrease in the concentration of lipids and increase of lean meat is due to the anti-GnRF action in immunocastration procedure, whose purpose is the decay of testosterone in the bloodstream, leading to an increase in physicochemical and sensory quality characteristics of pork (DUNSHEA et al., 2001).

Conclusion

Immunocastration did not affect performance traits. However, carcass quality was improved in immunocastrated animals by increasing leanness, belly and ribs and also boneless shoulder butt, and decreasing carcass yield, backfat and ham skin and fat.

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