EFFECT OF RACTOPAMINE AND IMMUNOCASTRATION ON PORK QUALITY*

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Abstract – The aim of the study was to evaluate the effect of ractopamine (RAC) and immunocastration on pork quality. Seven hundred ninety-two pigs (Camborough 25 x AGPIC 337) were studied in a 2 x 4 factorial design experiment: immunocastrated males (IM) and barrows (B) x 0, 5, 10 and 15 mg/kg RAC. Pigs were reared in 18 pens per level of RAC, half of which with B and half with IM. On slaughter day, two animals per pen were selected for meat quality analysis, totaling 144 samples of *Longissimus dorsi* (LD) muscle. Meat quality parameters such as pH, color, drip loss (DL), cooking loss (CL), shear force (SF) and marbling were evaluated. A model of variance analysis was applied for all these variables and the adopted decision-making criterion was at 5% of probability. The average comparisons were done through Student's t test. RAC supplementation in the diet increased shear force (P=0.001) and decreased (P=0.001) red color (a*). The red color (a*) and yellowness (b*) of IM's meat was lower (P=0.008 and P=0.028, respectively) than B's meat. We concluded that RAC in feed of finishing pigs and immunocastration affects meat quality parameters negatively.

Keywords – agonist β-adrenergic, castration categories, pH.

I. INTRODUCTION

Ractopamine (RAC) is a commercially available β-adrenergic agonist capable of routing nutrients to protein anabolism in detriment of lipid anabolism and has been added to the feed of finishing pigs. Immunocastration using anti-Gonadotropin Releasing Factor (anti-GnRF) vaccines is mediated by the production of anti-GnRF antibodies that directly inhibit the function of endogenous GnRF, causing temporary sterilization via suppression of the LH/FSH hormone pathway. Through strategic and timed application, an anti-GnRF vaccine improving meat quality, reducing sexual behavior, increasing production gains, maintaining animal welfare, was used as an alternative to surgical castration. This study aimed to assess the effect of this β-adrenergic agonist and immunocastration on pork quality.

II. MATERIALS AND METHODS

The experiment was developed according to the ethical principles of animal experimentation. One thousand, one hundred sixty male piglets were selected from 17 commercial farms, according to their weight at birth. Half of these piglets were surgically castrated, according to standard procedures of each farm. The remaining piglets were immunocastrated later, when they became growing- finishing pigs (the first dose was applied eight weeks before slaughter, and the second dose four weeks before slaughter). At 60 days, these pigs were weighed and distributed into nine blocks. From these blocks, nine pens were randomly selected for each level of RAC and categories of castration, totaling 72 pens (18 per each level of RAC, half of which were barrows - B and the other half were immunocastrated males - IM) and 792 pigs (11 per pen) to growing-finishing. Feed supplemented with RAC was provided in a controlled manner, 28 days before slaughter.

The diet used in this period was conventional feed with 1% of total lysine. On slaughter day, before the loading of animals, the pigs were weighed and two average-weight animals from each pen were selected for the analysis of meat quality, totaling 144 samples. The animals were submitted to four-hour fast and were hauled to a slaughterhouse. Then, the pigs were kept in the slaughterhouse's lairage for six hours until they were taken for stunning. The slaughter occurred by electrocution and the animals were immediately exsanguinated. The carcasses were split before entering the chiller with temperatures ranging from 1°C to 4°C for 24 hours; after that, measurements of meat quality were done in the *Longissimus dorsi* (LD) muscle, between the 13^{th} and 14^{th} ribs, perpendicularly to the medium line of the half-carcass and 3.5 cm deep. A pH measuring device with a digital identification system and the measurements were done in a period of 45 minutes (pH_{45}) and 24 hours *post-mortem* (pH_{24}). Color was evaluated using a colorimeter (Konica Minolta), in triplicate and following the CIELAB system, through the readings of light reflectance in three dimensions: L*, a* and b* (luminosity, tendency to red and to yellow, respectively). Drip loss analysis was done in duplicates by the EZ-DripLoss method [1] and the percentage of water loss was calculated [2]. Regarding cooking loss, the samples of LD were vacuum-packaged and cooked in water bath (80ºC for 1 hour). Next, they were weighed again to determine weight loss after cooking [3]. The samples used to determine cooking loss were used in order to evaluate shear force. Thus, 1x1x2 cm cubes were cut and placed with the fiber oriented perpendicularly to the blades of the Warner-Blatzler device. Marbling was evaluated by the standard photo guide of *Pork Quality Standards* (number value scales with the following variation: 1, 2, 3, 4, 5, 6 and 10). From the birth of the piglets to the beginning of the feeding supplemented with RAC, the model of variance analysis was applied using a randomized design with two symbolic treatments (B and IM). From the beginning of the feeding supplemented with RAC until slaughter, a 2 x 4 factorial randomized block design (two castration categories x four levels of RAC) was used. A model of variance analysis was applied to all these variables and the adopted decision-making criterion was 5% of probability. The average comparisons were done through Student's t test. A statistical analysis program [4] was used.

III. RESULTS AND DISCUSSION

It was found that meat of pigs fed with RAC supplemented diet had become less red (P=0.001) when compared with meat of pig from the control group (Table 1). The same was observed for IM's meat (P=0.008) compared with B's meat (Table 2). Dunshea et al. [5] also reported that the reduction in redness (a*) value was associated with feeding RAC, but they used 20 mg/kg.

Table 1 Averages of meat quality parameters on *Longissimus dorsi* of swines at different levels of dietary RAC supplementation

	RAC (mg/kg)			
Item	0	5	10	15
pH[1]				
pH_{45}	6.29	6.35	6.30	6.26
pH_{24}	5.25	5.28	5.26	5.26
Color[2]				
L*	46.46	46.21	45.60	45.96
a*	6.12^{a}	5.46^{b}	5.43^{b}	5.60^{b}
b*	-1.84	-2.03	-2.29	-1.98
DL[3], %	4.30	4.22	3.61	3.89
CL[4], %	36.07	35.97	35.84	35.62
SF[5], kg	4.627^{b}	6.015^{a}	6.151^{a}	5.711^{a}
Marbling	2.14	2.06	1.88	2.29

n = 144. Averages followed by distinct letters horizontally differ (P<0.05). [1] pH values measured at 45 minutes and 24 hours after slaughter. [2]CIELAB. [3]Drip loss. [4]Cooking loss. [5]Shear Force.

We found reduction in yellowness (b*) value (P=0.028) associated with immunocastration (Table 2). The negative value indicates tendency of the meat color from yellow to blue. However, changes of this parameter did not affect the pork quality. Carr et al. [6] also evaluated the LD muscle of pigs supplemented with 10 mg/kg of RAC and found a decrease for the values of b*. The RAC supplementation in the diet caused an

increase in shear force (P=0.001) in pork meat (Table 1). This is in agreement with some authors [7] that also found an increase in shear force when pigs were supplemented with RAC.

Table 2 Averages of meat quality parameters on *Longissimus dorsi* of swines at different castration categories (barrows - B and immunocastrated males - IM)

	Castration Category	
Item	B	IM
pH[1]		
pH_{45}	6.31	6.29
pH_{24}	5.27	5.26
Color[2]		
L*	46.09	46.05
a*	5.85[a]	5.50[b]
b*	-1.78[a]	-2.25[b]
DL[3], %	3.89	4.16
CL[4], %	35.78	35.97
SF[5], kg	5.461	5.723
Marbling	2.24	1.96

n = 144. Averages followed by distinct letters horizontally differ (P<0.05). [1] pH values measured at 45 minutes and 24 hours after slaughter. [2]CIELAB. [3]Drip loss. [4]Cooking loss. [5]Shear Force.

The shear force increase in pigs fed with RAC was verified by several authors and the main reasons for it are: RAC is responsible for the muscle fiber diameter increase [6] and possibly for the proteolytic enzyme calpain activity decrease [8]. According to Xiong et al. [9], the tenderness decrease is explained by the reduction of protein degradation and the myofibril breakage in the muscle of pigs receiving diet with RAC. All the values found for pH were within the desired range for pork, from 6.00 to 6.50 for pH_{45}, and from 5.50 to 5.80 for pH_{24}, regardless of RAC or castration category. There was no effect of RAC levels or even castration category on L*, b*, drip loss, cooking loss and marbling. Moore et al. [10] also found no effect of RAC or immunocastration on pH, drip loss and cooking loss. Aalhus et al. [7] and Patience et al. [11] also verified that the drip loss percentage was not affected (P>0.05) by the addition of RAC in the diet. Rincker et al. [12] verified that the cooking loss percentage was not affected by the 5 mg/kg supplementation of RAC in the feed. However, some authors [7] found an increase in cooking loss when pigs were supplemented with RAC. Stites et al. [13] did not find any effect of RAC on the marbling score of the LD muscle, agreeing with our results.

IV. CONCLUSION

These findings indicate that ractopamine supplementation and immunocastration affect pork quality parameters negatively. However, while ractopamine supplementation affects important pork quality parameters as tenderness and color, immunocastration only affects the meat color.

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