RACTOPAMINE HYDROCHLORIDE AND IMMUNOCASTRATION EFFECTS ON FRESH PORK PROPERTIES

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Abstract - One hundred ninety seven crossbred (Tempo, sires and Topigs 40, dams) pigs were penned in 12 groups with a total of 6 treatments and duplicate for the 2-way interaction, ractopamine (RAC, 7.5 mg/Kg during 21 days) versus sex (female, FE, male pigs castrated physically, PC, and immunologically, IC) aiming to clarify the interaction of these two technologies on pork quality traits. The statistical results showed no significant difference for both, RAC treatment and sex considering the ultimate pH measured in *Longissimus dorsi* (LD) and *Semimembranosus* (SM) muscle as well as Minolta LD colour (L*, a*, and b*). Nevertheless, the inclusion of RAC increased the objective shear force significantly (3.61 kg, P < 0.03) compared to the control pigs (3.36 kg) and IC pigs also presented greater (3.67 Kg, P < 0.04) shear force values than PC (3.30 Kg). The present study shows no interactive effect of ractopamine (RAC) and sex on the pork quality traits evaluated. The inclusion of RAC increased toughness of pork meat, however the shear force differences found in this study would not be detected by an untrained taste panel, accordingly to the scientific results reported from other authors.

Keywords - ractopamine, fresh pork properties, immunocastration.

I. INTRODUCTION

Ractopamine hydrochloride (RAC) is a β-adrenergic agonist that is included in finishing diets to improve swine performance. This metabolic modifier acts to direct nutrients to increase protein deposition [1] and to decrease adipose tissue accretion rate [2]. Although the economic benefits of the use of ractopamine in pigs are well established it is necessary to be aware of the possible changes that this additive causes on pork quality. Stahl et al. [3] and Fernández-Dueñas et al. [4] observed an increase in toughness in muscle of pigs fed 5 mg/kg RAC. Studies reporting the simultaneous use of immunocastration - vaccination against gonadotrophin releasing hormone (GnRH) that cause a temporary suppression of testicular function - and ractopamine feeding on quality traits seem to be inexistent. Thus, the objective of this study was to compare sex categories, diets with and without RAC, and to detect interactive effects between sex and ractopamine on fresh pork properties.

II. MATERIALS AND METHODS

Animals (n=60 - Topigs – Tempo sires x Topigs 40 dams) from a commercial farm were grouped in females (FE), physically castrated (PC) and immunocastrated male pigs (IC), fed or not with RAC (7.5 mg/kg, Ractosui®, Ourofino Agronegócio) for the final 21 d before slaughter. The boars designated to be immunocastrated received two doses of vaccine according to recommendation (Improvac®, Pfizer Animal Health). After slaughter carcasses were chilled and pH_{24h} was determined in the M. *semimembranosus* (SM) and M. *longissimus dorsi* (LD) using a Meat pHmeter (Hanna, Model H199163). Pork loin was deboned, and the LD were evaluated for objective colour (L*a*b*) using a Minolta Chromameter (CR-400; Konica Minolta Sensing, Inc.). For drip loss, LD samples (80 to 100 g) were placed in netting and suspended in an inflated bag for 24 and 48 h storage period at 4°C [5]. LD was sliced into a 2.54-cm-thick weighed and cooked on a clamshell style grill to an internal temperature of 72 °C, thus samples were

Table 1. Effect of sex and RAC on pork quality traits of objective colour, pH_{24h}, drip loss, cooking loss and shear force.

	Sex				Ractopamine, mg/kg			
Item	Female	Physically castrate	Immunocastrate	*P*- value	0.0	7.5	*P*- value	SEM
Ligthness (L*)	47.72	48.03	47.81	0.9	47.79	47.91	0.83	4.62
Redness (a*)	6.58	7.28	7.08	0.06	6.97	6.98	0.97	0.87
Yellowness (b*)	0.92	1.39	1.2	0.18	1.2	1.14	0.79	0.63
pH 24h (SM)	5.83	5.82	5.77	0.54	5.77	5.85	0.09	0.03
pH 24h (LD)	5.4	5.39	5.38	0.76	5.38	5.39	0.67	<0.01
Drip loss 24h, %	4.85	6.21	5.99	0.11	5.35	6.07	0.21	4.2
Drip loss 48h, %	7.61	8.99	8.86	0.15	8.3	8.7	0.53	5.49
Cooking loss, %	24.01^{b}	24.58^{ab}	26.4^{a}	0.01	24.55	25.46	0.16	6.24
Shear force, Kg	3.49^{ab}	3.30^{b}	3.67^{a}	0.04	3.36^{b}	3.61^{a}	0.04	0.19

[a,b] Within a row, means with different superscripts differ ($P < .05$).

reweighted to determine cooking loss which was expressed as a percentage of the initial sample weight. Texture was determined using the 3 mm thick Warner-Bratzler shear force (WBSF) attachment to the TAXT2i Texture Analyser. The experiment was carried out as a factorial (2 x 3) arrangement with RAC diet (0 and 7.5 mg/kg) and sex condition (FE, PC and IC). Data were analyzed by ANOVA using the GLM procedure of SAS (SAS Inst., Inc., Cary, NC) with a model including RAC, sex, and their interactions. Least squares means were separated by the PDIFF, and statistical differences were declared at $P \leq 0.05$ level.

III. RESULTS AND DISCUSSION

There was no RAC × sex ($P > 0.05$) interaction for any of the pork properties studied. RAC treatment and animal sex condition did not influence the pH_{24h} values of the SM and LD ($P \geq 0.09$), the drip loss 24 and 48h ($P \geq 0.11$) and also the objective colour ($P \geq 0.09$). In respect to objective colour these results are consistent with Armstrong et al. [6], Carr et al. [7] and Sthal et al. [3]. Stoller et al. [8] found no difference ($P < 0.05$) in pH_{24h} values for PC and FE. However, Carr et al. [7] reported higher pH_{24h} values in LD from pigs treated with RAC, but did not find the same results when pH was measured in SM. Sthal et al. [3] also demonstrated no difference ($P < 0.05$) in RAC fed pigs and control. Several studies observed that drip loss percentage is not commonly affected by RAC [9] [8] [10]. However, when a high RAC concentration (20 mg/kg) is used a reduction of LD drip loss may be presented as Carr et al. [7] reported in their study. The drip loss (48 h) percentage for RAC treatment and sex ranged from 7.61 to 8.99 and the 24 h drip loss ranged from 4.85 to 6.21. Warriss et al. [11] classified as normal (RFN) pork samples with an average drip loss of 10.3%. Additionally, the pH_{24h} for animal sex and RAC fed pigs ranged from 5.38 to 5.85, what is considered normal for pork quality [12]. The most important measure in CIE colour space for pork quality is the L*. Warner et al. (1997) [13] and Faucitano et al. (2010) [12] reported a classification of $L^* < 42$ to DFD pork and $L^* > 50$ to PSE and PFN pork, with values in the range being RFN. In our study, the mean values for RAC treatment and sex ranged from 47.72 to 48.03, which is a very desirable reddish-pink colour. RAC supplementation did not affect ($P = 0.16$) cooking loss. Cooking loss is not commonly affected by RAC diet [3] [14] [4], however Uttaro et al. [9] found greater cooking loss values for control pigs than for pigs treated with 20 mg/kg RAC. Cooking loss from IC presented higher values than FE ($P = 0.01$), but both did not differ from PC ($P > 0.05$ In

agreement, Fernández-Dueñas et al. [4] found no effect of animal sex for cooking loss from FE and CM. Considering the results for both pigs fed RAC as for animal sex in respect to pH, lightness and drip loss percentage evaluate in the LD muscle 24 h *post mortem* are within the criteria for classification of RFN or normal (pH = 5,45 ± 0.15; L* = 54.3 ± 3.12 and drip = 10.3% ± 2.88) reported by Warriss et al. [11]. LD from RAC fed pigs presented higher (P = 0.04) WBSF means than control diet and IC also showed greater values than PC (P = 0.04) and FE did not differ from both (P > 0.05). Fernández-Duñas et al. [4] reported significant differences in tenderness (P < 0.05) between sexes, though LD from CM was more tender than that from FE and Stoller et al. [8] also found LD from CM was rated more tender than that from FE; however in both studies sensory panel evaluation did not detect this differences in tenderness. Previous study also reported an inverse relationship between dietary RAC supplementation and meat tenderness [9] [15] [3] [4]. Xiong et al. [16] found *longissimus* muscle from RAC-fed pigs 20% greater (P < 0.01) than that of muscle from control pigs, however, when submitted to ageing process the WBSF of RAC muscle decreased rapidly, while muscle from the control group showed a slower rate of WBSF reduction and after 10 days ageing the shear force values of muscle from RAC-fed and from control pigs were identical. Carr al. [7] also reported greater shear force values for loins from pigs treated with RAC and compatible results by trained sensory evaluation panel. In contrast, work conducted by Apple et al. [14] and Stites et al. [17] found no difference in tenderness between the loin chops from pigs treated with 10 mg/kg of RAC and control. The enhancing protein synthesis and decreasing adipose tissue accretion rate in pigs fed RAC has resulted in some concern about pork quality especially in toughness of the meat.

It is presumed that the decreased of tenderness in pigs fed RAC can be caused by the more cross-linked collagen than normal [18]. Additionally, Aalhus et al. (1992) suggested that ractopamine increased muscle fibers diameters. The larger diameter fiber can be associated with decrease of tenderness independent of connective tissue strength or age [19].

IV. CONCLUSIONS

Immunocastrated increased cooking loss and texture of pork in this research. The addition of RAC on diet of finishing pigs increased cooking loss and toughness, however accordingly to other scientific results the shear force differences found in this study would not be detected by an untrained taste panel.

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