INFLUENCE OF RACTOPAMINE AND IMMUNOLOGICAL CASTRATION ON PORK BELLIES CHARACTERISTICS AND BACON YIELD

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Abstract - Sixty fresh bellies from two commercial farms crossbred pigs "Tempo sire and Topigs 40 dam" and "G337 sire and CB22 dam" from a total of 12 treatments, distributed in a 2 x 3 randomized factorial block design: two ractopamine (RAC) levels (0 and 7.5 ppm) and three genders (immunocastrated, physically castrated, and gilts). Bellies were fabricated and evaluated for quality characteristics: length, width, thickness, firmness, and process yield. The ractopamine had no significant effect on most bellies characteristics, but increased the belly meat weight and had positive effects on bacon yield. Few differences were observed on belly thickness. All bellies from pigs fed with RAC had adequate thickness for bacon production. Firmness was greater for barrows and immunocastrated pigs, from commercial farm crossbred "Tempo sire and Topigs 40 dam" pigs, suggesting more desirable bellies for bacon slicing. The results of the present study would suggest that the combination of ractopamine and castration method "immunological and physical-castration" has improved the effects on some important belly attributes (firmness and meat weight) and process yield.

Key words – immunological castration, pork belly characteristics, ractopamine.

I. INTRODUCTION

The ractopamine hydrochloride (RAC) is a β-adrenergic agonist that increases lean meat yield, decreases the quantity of saturated fatty acids [1], and improves polyunsaturation of pork fat [2]. RAC has been shown to improve growth rate and the efficiency of growth, without negatively affecting belly characteristics [2]. Researches demonstrated that RAC did not affect fresh belly thickness or cooking properties, palatability or consumer acceptance of bacon, which are in agreement with processor´s concern about belly quality [1; 3]. Physical castration is the most common method to reduce the incidence of boar taint. Castration of young male piglets without anesthesia were prohibited in various European countries (Switzerland, Sweden, The Nederland, Belgium, Denmark and Germany), becoming an important issue on the political agenda. Boar taint is mainly caused by high concentrations of androstenone, skatole and/or indole in the adipose tissue [4]. The immunological castration is a technique to decrease reproductive efficiency by immunogenic substances. The technique is based on inducing antibodies against gonadotropin releasing hormone (GnRH) [5]. The genetic potential of commercial swine operations has changed drastically over the last decades in selecting pigs by genotype, by which positive results have been found to reduce fat and increase lean meat in swine carcasses as well as to improve growth rate and efficiency [6]. These changes have resulted in decreases in the thickness of bellies. This is a cause of concern because thicker bellies have been found to have higher processing yields than thinner bellies [7] which were not related to weight [3]. Among the various fat depots in pig carcasses, it is the belly which has been affected the most by the selection to decrease the fatness level of the pig carcass [8]. Several studies have examined the relationship of lean meat in the belly with carcass weight and back fat and other studies evaluated the relation of carcass measurements with lean meat distribution, slice dimensions, and belly and bacon yields [9] and [7], cited by [6]. Therefore, the objective of this study was to determine belly physical characteristics and bacon yield as affected by immunological castration and RAC diet in pigs from two different crossbred pigs.

II. MATERIALS AND METHODS

This study involved one hundred ninety-seven crossbred pigs "Tempo sire and Topigs 40 dam"

and "G337 sire and CB22 dam". The factorial arrangement applied in this study was as follow: 2 dietary ractopamine levels (0.0 and 7.5 ppm, during 21 days), 3 genders (barrows, immunocastrated and gilts) and 2 crossbred pigs "Tempo sire and Topigs 40 dam" and "G337 sire and CB22 dam". Sixty fresh bellies representing each treatment (5 replications) were evaluated for quality characteristics: length, width, thickness, and firmness (belly curvature measured by placing it on a 7.6 cm rod). Then, the fresh bellies were identified, vacuum-packaged, boxed, frozen at -18 °C for further processed purposes in an industrial plant. The bacon yield was calculated using Equation 1.

Process Yield: (cooked weight/raw belly weight) x 100 (1)

The left side of each carcass was collected to evaluate the belly meat. Data were analyzed by SAS [10] with main effects of RAC level, genetic, and genders identified by the analysis of variance (ANOVA). Significant ($p < 0.05$) differences between means were obtained by applying Tukey test.

III. RESULTS AND DISCUSSION

Belly characteristics as affected by RAC levels are presented in Table 1. In the current study, the addition of RAC did not alter ($p > 0.05$) length, width, firmness, thickness and bacon yield. Similar results were reported by Scramlin and colleagues [9] where no differences were observed in average belly thickness, length or firmness between the control and RAC (7.4 mg/kg) group. Similarly, other researchers reported no impact of RAC on belly length, width, and thickness [3], as well as no impact on firmness [2] working at 10 mg/kg of RAC.

Belly meat weight (kg) and processed yield was affected ($p<0.05$) by RAC in this study. Other studies found no effect of RAC treatment on weight of the boneless belly [11]. There is also a major concern in the use of repartitioning agents since the belly may possibly become thinner and result a reduction in process yield. The current data obtained showed a positive effect on process yield without requiring an increase in belly thickness which could be beneficial to the bacon industry. Carr et al. [2] reported that feeding diets including 10 or 20 mg/kg of RAC had no effect on belly firmness measurements, however, in another experiment the same authors, feeding 10 mg/kg of RAC produced substantially softer bellies, but firmness measurements did not differ between RAC treatments. These authors reported that higher belly firmness measurement indicates a firmer, higher-quality belly. Other study including 5 or 7.4 mg/kg of RAC on diets observed a trend in bacon and belly quality, where the positive effects of RAC seem to reduce as the level increases to 7.4 ppm. This may result from either saturation of the ß-agonist receptors or a decrease in receptor density due to down regulations, thereby reducing the impact of the RAC molecule [9].

Table 1. Mean value of belly characteristics varying the ractopamine levels

	RAC level (ppm)	
	0	7.5
Length (cm)	36.51	37.28
Width (cm)	26.57	26.92
Firmness (cm)	11.82	13.45
Thickness (cm)	3.54	3.74
Meat weight (kg)	2.72^{B}	2.94^{A}
Process yield (%)	82.42^{B}	83.71^{A}

^{AB} Means within row with different superscripts differ ($p < 0.05$).

Table 2. Mean value of belly characteristics varying the crossbred pigs

	Tempo sire and Topigs 40 dam	G337 sire and CB22 dam
Length (cm)	35.83^{B}	38.44^{A}
Width (cm)	24.08^{B}	26.85^{A}
Firmness (cm)	14.66^{A}	11.27^{B}
Thickness (cm)	3.55	3.42
Meat weight (kg)	2.74	2.92
Process yield (%)	83.22	82.91

^{AB} Means within row with different superscripts differ ($p < 0.05$).

The influence of crossbreeding pigs on belly characteristics showed no effect ($p>0.05$) on average belly thickness, meat weight or process yield (Table 2) but it affected ($p < 0.05$) length,

width and firmness. The crossbred "G337 sire and CB22 dam" pigs, seem to have positive influence on most belly characteristics and bacon yield, showing larger bellies, however, with low firmness.

As far as the influence of gender on belly characteristics is concern it was observed a significant effect ($p < 0.05$) on firmness and meat weight (Table 3) but no influence on belly length, width, thickness, and process yield ($p > 0.05$). Barrow and immunocastrated had higher meat weight ($p < 0.05$) compared to gilts, showing heavier boneless bellies. This result may lead to improve consumer acceptance of bacon slices from barrow or immunocastrated, as consumers seem to prefer higher lean meat content [7]. Another research reported impact on thickness and increased weight of barrow compared to gilts [12]. Firmness was greater for barrows and immunocastrated, crossbred "Tempo sire and Topigs 40 dam" pigs, suggesting these bellies would be more desirable for bacon slicing and apparently higher quality belly [2]. However, no significant difference was found for belly thickness ($p > 0.05$) as related to genders.

Table 3. Mean value of belly characteristics varying genders

	Gender		
	Gilt	Barrow	Immunocastrated
Length (cm)	36.52	37.08	38.00
Width (cm)	25.12	25.45	25.37
Firmness (cm)	11.51^{B}	14.37^{A}	13.00^{AB}
Thickness (cm)	3.64	3.86	3.50
Meat weight (kg)	2.61^{B}	3.00^{A}	2.87^{A}
Process yield (%)	82.45	84.20	82.54

^{AB} Means within row with different superscripts differ ($p < 0.05$).

IV. CONCLUSION

The results obtained from the present study would suggest that RAC may improve belly characteristics, not adversely affecting belly thickness or bacon process yield. Furthermore, barrow and immunocastrated pigs had better belly characteristics and bacon yield compared to gilts.

The benefits of RAC and crossbred G337 sire and CB22 dam pigs obtained for bacon yields and for some belly characteristics would also be beneficial for other areas of swine production which may require higher lean meat contents.

The combination of RAC and castration method "immunological and physical-castration" has improved the effects on some important belly attributes (firmness and meat weight) and process yield.

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