Effect of beta-agonists on meat quality of Nellore Cattle

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Abstract - Beta-adrenergic agonists (βAA) are non-hormonal growth promoters that increase muscle and decrease fat deposition, but are also negatively associated with meat quality. This study was conducted to evaluate the effect of the beta-agonists zilpaterol and ractopamine on meat quality characteristics of feedlot finished Nellore cattle. Forty-eight non-castrated males were fed for 70 days a diet containing 76% concentrate and 24% roughage (corn silage). After this period, the animals were divided in three groups, one remained with the same diet, considered the control group (CON), and the other two had added to this diet 80mg/day of zilpaterol hydrochloride (Zilmax®) or 300mg/day of ractopamine hydrochloride (Optaflexx®), respectively, ZIL and RAC treatments. The animals received these treatments during 30 days. After slaughter samples of the *Longissimus dorsi* muscle were collected to evaluate cooking loss, Warner-Bratzler shear force and L*, a* and b* color attributes. There was no effect of beta-agonists on meat quality traits of feedlot finished *Bos indicus* cattle.

Key Word– Feedlot; Zilpaterol; Ractopamine.

1 INTRODUCTION

To increase meat production to attend demand is one of the most challenging tasks for meat production in the next years. There are several ways to improve meat yield and quality, involving animal management, nutrition, crossbreeding, among others.

One strategy to improve the performance of beef cattle is the use of additives such as beta- adrenergic agonists (βAA).

The βAA are a class of pharmacological compounds with similar chemical structure to the group of natural compounds called catecholamines and are used to increase muscle growth of beef cattle. These compounds stimulate the β-adrenergic receptors and promote protein synthesis and cell hypertrophy by inhibiting proteolysis in the tissue while promoting lipolysis, thereby reducing the fat [1].

Activation of the kinases, protein dependent of calcium, and the action in some β (β1, β2 and β3) receptors, can increase the synthesis and/or decrease muscle protein breakdown and reduce carcass fat [2]. The difference between these two βAA, ractopamine and zilpaterol, is the specificity for adrenergic receptors, the first is a β1-selective adrenergic receptor, whereas the last is a β2-selective [3].

However, decrease in meat tenderness when the βAA are used has been reported [4], but, nevertheless, it is important to evaluate the effects of these products in *Bos indicus* cattle, since they account for approximately 95% of Brazilian herd. Additionally, most studies about the use of βAA were carried out in European continental and British breeds, with no information about the impact of these products in Bos indicus animals. Therefore, this work was conducted to evaluate the effects of different βAA products on meat quality traits of feedlot finished Nellore cattle.

2 MATERIALS AND METHODS

Forty-eight non-castrated Nellore males (409±50 kg LW; 20 months old) were feedlot fed for 70 days a common diet containing 76% concentrate and 24% roughage (corn silage). After this period, the animals were divided in three groups, one remained with the same diet, considered the control group (CON), and the other two had added to this diet 80mg/day of zilpaterol hydrochloride (Zilmax®, MSD Animal Health, São Paulo, SP, Brazil) or 300mg/day of ractopamine hydrochloride (Optaflexx®, Elanco Animal Health, São Paulo, SP, Brazil), respectively, ZIL and RAC treatments. The animals

received these treatments during 30 days. After this period the animals were slaughtered according to humanitarian slaughter procedures as required by Brazilian laws. After 48h of chilling (0-2 °C) carcasses were ribbed between 12th and 13th ribs and a sample (2.5 cm thick) of the *Longissimus dorsi* muscle (LM), was taken for analysis of L*, a*, b* color, cooking losses (CL) and Warner-Bratzler shear force (WBSF). The samples allowed to bloom for 20 minutes and then the L*, a*, and b* values were measured using a Minolta spectrofotometer (CM2500d, Konica Minolta Sensing Inc., Osaka, Japan) in the CIELAB space.

The light source was set to D65 with observation angle set to 10° and aperture size of 30 mm. The instrument was previously calibrated according to the manufacturer's specifications.

Measurements were replicated in different portions of LM and the average of three measurements was considered as the color value. The color saturation (chroma), which is a measure of the intensity of the red color, was calculated from the formula [(a*)2 + (b*)2]0.5 and hue, a measure of the total color, was calculated from arc tan b*/a*.

The WBSF was analyzed according to the AMSA [5]. A digital thermocouple was inserted in the geometric center of each sample and cooked in a convection oven pre-heated to 170 °C. All steaks were turned after reaching an internal temperature of 40 °C and removed when the internal temperature reached 71°C. Samples were allowed to reach the room temperature (22 °C) and then were wrapped in a plastic film and cooled in refrigerator (2-5°C) for 24h. The WBSF was determined from six replicates (1.27 cm diameter) with fiber direction parallel to the longest dimension of the strip and perpendicular to the direction of the blade using a WBSF equipment (G-R Manufacturing Co., Manhattan, KS, USA) equipped with a WB blade. The CL was calculated by difference of weight of samples before and after cooking and are expressed in percentage. Data was analyzed as a randomized complete block (initial weight) design. The effect of treatments was analyzed by ANOVA and means compared by Student T test, using the SAS software (SAS Institute Inc.,Cary, NC).

3 RESULTS AND DISCUSSION

The average daily gains were (530, 536, and 541 kg/day) for CON, RAC and ZIL, respectively. There was no effect of treatments on meat color traits (Table 1). All color variables evaluated can be considered within the normal range, expected for consumer acceptance.

Our results differ from those found by Ferreira and Bastos [6], that reported darker meat for animals supplemented with ractopamina. According to the authors, this happened due to the stimulation of ante-mortem glycogenolysis, leading to reduced muscle glycogen and limiting the normal post-mortem acidification.

Table 1 – Means, standard errors of means (SEM) and probabilities (Pr>F) of meat color attributes according to the treatments.

Trait	Treatments[1]			SEM	Pr >F
	CON	RAC	ZIL		
L*	34.1	33.9	33.7	1.15	0.9785
a*	13.8	13.8	13.4	0.47	0.8126
b*	6.1	6.1	6.6	0.62	0.8302
Chroma	15.3	15.2	15.1	0.60	0.9685
Hue	0.4	0.4	0.5	0.04	0.6076

[1] CON - control diet; RAC – diet with ractopamine hydrochloride; ZIL – diet with zilpaterol hydrochloride.

The data of this study was different from that of Avendaño-Reyes et al. [7] that reported a decrease of Chroma values in meat of animals fed βAA in comparison to control animals.

In the same way, there were no treatments effects on cooking loss and WBSF (Table 2).

Table 2 – Means, standard errors of means (SEM) and probabilities (Pr>F) of meat quality traits, according to treatments.

Trait	Treatments			SEM	Pr >F
	CON	RAC	ZIL		
Cooking loss	18.5	21.6	21.0	1.29	0.2193
WBSF	4.9	5.6	5.4	0.53	0.6358

[1] CON - control diet; RAC – diet with ractopamine hydrochloride; ZIL – diet with zilpaterol hydrochloride.

Different results were reported by Rathmann et al. [8] who verified that animals fed βAA produced tougher meat. In the same way, Strydom et al. [9] also observed less tender meat of Bonsmara breed supplemented to ZIL in comparison to RAC and CON.

4 CONCLUSION

Under the conditions of this study, the βAA had no effect on quality characteristics of fresh meat from non-castrated *Bos indicus* (Nellore) cattle.

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