IMMUNOCASTRATION IMPROVES REDNESS OF LONGISSIMUS THORACIS STEAKS FROM FEEDLOT-FINISHED CROSSBRED (NELLORE × ABERDEEN ANGUS) CATTLE IN BRAZIL

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Abstract – Immunocastration, crossbreeding, and feedlot finishing are becoming common in Brazilian beef production systems due to economic reasons. However, limited information is available on the influence of immunocastration on beef quality of crossbred cattle finished in Brazilian feedlots. Therefore, the objective of the present study was to examine the effects of immunocastration on meat quality of crossbred beef animals (Nellore × Aberdeen Angus) finished in feedlot. Surgically castrated, immunocastrated, and intact males were finished in feedlot for 90 days. The animals were harvested, carcasses were chilled, and one 2.5-cm steak was fabricated from *Longissimus thoracis* muscle. The steaks were individually vacuum packaged and frozen at −18°C. Frozen steaks were thawed, and pH, instrumental color, cooking loss, and shear force were evaluated. Steaks from immunocastrated animals exhibited greater ($P < 0.05$) surface redness (a^* values) than those from intact animals indicating possible advantage in retailing. On the other hand, all treatments did not show differences ($P > 0.05$) on pH, L^* value, cooking loss, and shear force. Our results suggested that immunocastration could be utilized as a pre-harvest strategy to improve redness in *Longissimus thoracis* steaks from feedlot-finished Nellore × Aberdeen Angus males.

Key Words – immunocastration, feedlot, meat color

I. INTRODUCTION

More than 75% of the Brazilian beef cattle are *Bos indicus* animals, of which Nellore is a major breed. *Bos indicus* animals are late maturing compared to their European (*Bos taurus*) counterparts, and therefore Nellore animals have been crossbred with European breeds for genetic improvement of beef herds in Brazil. The major European breed used for crossbreeding is Aberdeen Angus (1). The crossbred animals demonstrate improved performance, carcass traits, and meat quality compared with *Bos indicus* animals.

However, a major disadvantage in raising crossbred animals in pasture is their high nutritional requirements, and crossbreds require high-energy diets for weight gain (2). In this context an alternative strategy is finishing crossbred cattle in feedlot, which is becoming a popular production practice in Brazilian beef industry.

Surgical castration decreases aggressiveness in male animals and improves beef quality traits. However, surgically castrated animals often exhibit low performance. Furthermore, surgical castration is considered as a questionable animal welfare practice (3). Immunocastration prevents aggressive behavior and mitigates undesirable carcass characteristics (4). The anti-GnRH vaccine neutralizes GnRH and inhibits the release of sex hormones (5). Since anti-GnRH vaccination exerts effect in relatively short time, immunocastration can be applied in beef animals immediately before their transference to feedlot or while being finished in feedlot.

The influence of immunocastration on meat quality of crossbred beef cattle finished in Brazilian feedlots has not been investigated. Therefore, our objective was to examine the effects of immunocastration on quality attributes of beef from crossbred Nellore × Aberdeen Angus males animals finished in Brazilian feedlot.

II. MATERIALS AND METHODS

The protocol for animal care and handling was approved by the Ethics Committee on Use of Animals at the Universidade Estadual Paulista, Botucatu, Brazil. Thirty male crossbred (Nellore × Aberdeen Angus) beef animals were utilized in this study. The cattle were raised on pasture (*Brachiaria brizantha* cv. *Marandu*) from birth until their transference to feedlot. Ten males (n = 10) were surgically castrated 28 days before entering the feedlot. Ten animals were immunocastrated by vaccinating twice with anti-GnRH vaccine (Bopriva, Pfizer Animal Health) at 28 days and one day before being transferred to the feedlot. Ten males were kept intact (non-castrated). Once the animals entered the feedlot, they were randomly allotted to individual pens and fed *ad libitum* with a high-grain diet containing 85% of concentrate. The average weight at transfer was 505 kg, and the age was between 19 and 21 months. The finishing period at the feedlot lasted 90 days.

The cattle were fasted for 18 hours and were humanely harvested under Brazilian federal inspection. The carcasses were chilled overnight at 2°C before fabrication, and one 2.5-cm steak was removed from the *Longissimus thoracis* muscle at the 12th rib. The steaks were individually vacuum packaged and frozen at –18°C until further analysis.

The frozen steaks were thawed overnight at 2°C before evaluation of meat quality attributes. The pH was measured using a probe-type portable pH meter (Hanna Instruments, Woonsocket, RI, USA). Thawed steaks were allowed to bloom for 30 min before instrumental color analyses. *L** (lightness), *a** (redness), and *b** (yellowness) values were measured on the surface at three random locations using a Minolta CR-400 colorimeter (Konica Minolta Sensing, Osaka, Japan) with illuminant C, 8 mm aperture, and 2° observer angle (6).

The steaks were then cooked in a clamshell grill to an internal temperature of 71°C. Internal temperature was measured using a digital thermometer inserted at the geometric center of the steak. The steaks were weighed before and after cooking. Cooking loss was calculated from the difference in the weight of raw and cooked steaks and expressed as percentage of initial weight. Cooked steaks were cooled for 12 h at 4°C, and six cylindrical cores of 1 cm diameter in the direction of the muscle fiber were taken from the samples. These cores were sheared using Warner-Bratzler probe attached to a TA-TX2i texture analyzer (Stable Micro System, Surrey, United Kingdom) set at a speed of 20 cm/min (7).

The experiment was a completely randomized design with ten replicates (n = 10). Data were analyzed through the MIXED procedure (8) using covariate, which was the bodyweight of the animals 40 days prior to feedlot transfer. The means were compared by Student's t-test at $P < 0.05$.

III. RESULTS AND DISCUSSION

Sexual conditions did not influence pH of beef ($P > 0.05$; Table 1). In agreement with our results, Amatayakul-Chantler et al. (9) did not find differences in pH between immunocastrated and non-castrated crossbred (*Bos indicus* × Brown Swiss) beef animals finished in Mexican feedlot. Furthermore, other authors did not find pH differences in beef from surgically castrated and immunocastrated Nellore males finished on pasture (10).

Table 1: Effect of sexual condition on quality attributes of *Longissimus thoracis* muscle from crossbred (Nellore × Aberdeen Angus) beef cattle finished in feedlot.

	Sexual condition		
Quality attribute	Surgically castrated	Immunocastrated	Intact
pH	6.03	5.98	6.23
*L** value	33.29	34.82	32.95
*a** value	16.91^{xy}	18.33 ^{x}	16.54 ^{y}
*b** value	4.54 ^{xy}	5.13 ^{x}	3.65 ^{y}

Cooking loss (%)	21.60	22.98	19.48
Shear force (N)	56.60	53.37	48.85

[x–y] Means in a row without common superscripts are different ($P < 0.05$).

The sexual condition did not influence ($P > 0.05$) the L^* values (lightness) of steaks (Table 1). In agreement with our results, Amatayakul-Chantler et al. (9) reported similar L^* values for steaks from intact and immunocastrated crossbred animals finished in feedlot. The sexual condition influenced ($P < 0.05$) a^* value (Table 1), and the steaks from immunocastrated animals demonstrated greater redness ($P < 0.05$; greater a^* value) than the steaks from intact animals. However, the steaks from immunocastrated and surgically castrated animals did not demonstrate any difference ($P > 0.05$) in redness. There was no difference ($P > 0.05$) in a^* values of steaks from intact and surgically castrated animals. In contrast to our findings, Amatayakul-Chantler et al. (9) did not observe any differences in a^* values of steaks harvested from non-castrated and immunocastrated crossbred animals finished in feedlot. In partial agreement with our results, previous report (10) observed no difference in a^* values of steaks from surgically castrated and immunocastrated Nellore animals on pasture. Furthermore, Costa et al. (11) examined the color traits of fresh beef from surgically castrated and non-castrated crossbred animals finished in feedlot and observed no difference in surface redness. Our results indicate that immunocastration improved redness of steaks from crossbred animals finished in feedlot, when compared to intact males. Surface redness is an important trait influencing consumer purchase decision of fresh beef (12), and immunocastration may be exploited as a pre-harvest strategy to improve color and marketability of fresh beef.

Yellowness (b^* value) was influenced ($P < 0.05$) by the sexual condition (Table 1). The steaks from intact animals demonstrated lower ($P < 0.05$) b^* values than those from immunocastrated ones. However, b^* values were not different ($P > 0.05$) for the steaks from immunocastrated and surgically castrated animals. There was no difference ($P > 0.05$) in the b^* values of steaks from intact and surgically castrated groups. In agreement with our results, Costa et al. (11) documented no difference in b^* values of fresh beef from non-castrated and surgically castrated crossbred animals finished in feedlot. Furthermore, other researchers (9) did not observe any differences in b^* values of beef from intact and immunocastrated crossbred animals finished in feedlot.

Cooking loss affects palatability attributes (13) and ultimately influences acceptability. In the present study, cooking loss was not influenced ($P > 0.05$) by sexual conditions (Table 1). A limited number of investigations have examined cooking loss in beef from immunocastrated animals, and the previous reports are in agreement with our observations. Ribeiro et al. (14) compared cooking loss in beef from surgically castrated, immunocastrated, and intact Nellore animals on pasture and found no difference among the three treatments. Furthermore, Amatayakul-Chantler et al. (10) found no differences in cooking loss of steaks from surgically castrated and immunocastrated pasture-raised Nellore animals. Moreover, Costa et al. (11) did not observe any difference in cooking loss in steaks from surgically castrated and intact crossbred (Nellore x Charolais) animals. Additionally, Vaz et al. (15) reported no difference in cooking loss for steaks from Hereford bulls and surgically castrated animals.

Shear force was not influenced ($P > 0.05$) by sexual conditions (Table 1). In partial agreement with our results, several previous studies reported that immunocastration had no influence on shear force of beef from *Bos taurus* animals finished in the feedlot (16) and Nellore animals on pasture (10, 14). However, Amatayakul-Chantler et al. (9) observed greater shear force for steaks from bulls than those from immunocastrated crossbred animals in feedlot. Our results are in conflict with previous studies comparing shear force of beef harvested from surgically castrated and intact crossbred animals; previous investigations documented greater shear force for steaks from bulls than those from steers (11, 17). The observed differences on shear force between our results and the previous reports could be attributed to the differences in the age of the animals at harvest (22–24 months in the present study vs. 6–24 months in the previous investigations) and the age at which surgical

castration was performed (18–20 months in the present study vs. 3–8 months in the previous investigations).

IV. CONCLUSION

The results of the present study indicate that beef from immunocastrated crossbred cattle demonstrated greater redness than beef from intact males suggesting a possible better marketability. Brazilian beef industry may exploit immunocastration as a logical strategy to improve surface color in crossbred (Nellore × Aberdeen Angus) animals finished in feedlot.

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