EFFECT OF THE CASTRATION METHOD ON STEERS PERFORMANCE AND MEAT QUALITY

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Abstract. Five groups of Braford male calves (n = 10 each) were castrated at 7 months of age by either 1) Surgery plus local Anesthetic, 2) Burdizzo, 3) Rubber ring, 4) Surgery plus anti-inflammatory, or 5) Traditional surgery (without pain mitigation) to determine the effect of the castration method on calves growth and development and also on meat quality. Live weight evolution was registered each 15 days and 4 ultrasound measures were performed during the finishing period (14 months). Carcass pH, meat color and shear force were determined with 2 and 14 days of aging. No differences in growth were found between Treatments and all of them reach the slaughter point at the same time. Meat brightness (*L) and redness (*a) were lower in meat coming from animals castrated by traditional surgery when compared to those where anesthetics was used before surgery. The evaluated castration methods did not determine differences in carcass pH nor in shear force values.

I. INTRODUCTION

Castration of male beef cattle is performed to reduce aggressiveness, prevent physical danger to other animals in the herd and to handlers, enhance reproductive control, manage genetic selection, and satisfy consumer preferences regarding taste and tenderness of meat. According to several authors, entire animals show many disadvantages in meat quality when compared to castrated males, regarding tenderness, meat color, fat cover and marbling (1, 2, 3).

Castration of young bulls is a necessary management practice in beef production, especially in extensive conditions with an average slaughter age of around 3 years old. The most common methods for castrating male cattle are the surgical and rubber banding methods. The method (4) and the age of castration (5) are important stressful factors that affect not only the animal welfare but also the animal performance (6). In that sense, this experiment was performed to determine the impact of different castration method on animal growth and meat quality.

II. MATERIALS AND METHODS

The experiment procedure was approved by the Ethical Committe of INIA for the care and use of animals for research.Fifty Braford steers were randomly assigned to 5 Treatments according to the castration method: 1) Surgery plus local anesthesia (8 ml of lidocaine), 2) Burdizzo forceps, 3) Rubber rings, 4) Surgery plus anti-inflammatory (Dexamethasone), or 5) Traditional surgery (without pain mitigation). After castration steers entered a feed lot system for finishing purposes and liveweight was registered each 14 days. Ribeye area and fat cover were measured 4 times by ultrasound, during the finishing period. Animals were slaughtered when they reached an average final live weight of 500 kg in each Treatment, with 20 months of age. Slaughter was performed in a commercial abattoir licensed to export meat and following AW standard procedures. Carcass pH was measured between the 11th and 13th rib at 2 and 14 days *post mortem* at *Longissimus thoracis et lumborum* (LM) muscles. To record the pH, a pH meter (Orion 210A) with a device gel was used. Muscle color was measured on the LM at L* (luminosity), a* (red index) and b*

(yellow index) color space (6), after 2 and 14 days of aging using a Minolta ® (Model 400 C) colorimeter. The values were recorded in three different regions of each sample to obtain a representative average value of the color of the meat sample. Shear force measurement was obtained also on the LM and after 2 and 14 aging days using Warner Bratzler device. Six pieces of 1.27 cm diameter were taken of each sample following the direction of the muscle fibers, using a biopsy forceps. From six measurements of each meat sample, the mean value was calculated. The method used for the analysis of shear force (SF) was based on the work of Purchas et al. (7). Data was analyzed by the SAS software applying GLM and GLIMMIX procedures using mixed models adjusted for repeated measures.

III. RESULTS

Animals reached the slaughter point at the same time with 20 months of age and without differences between Treatments. No differences in ribeye area were found between Treatments, during the evaluation period and immediately before slaughter (p>0,05; Table 1).

Table1. Ribeye area. Ultrasound measures. 4 measurements (in the period between castration and the slaughter day - 14 months)

Ribeye area (cm^2) dates	T1	T2	T3	T4	T5
1	40,5	40,4	41,1	40,5	40,9
2	44,4	45,7	46,5	45,6	45,7
3	52,7	54,6	54,3	54,6	54,0
4 (pre slaughter)	68,5	66,8	64,9	64,5	65,1

Treatments with different letter in the same line, differ with p<0.05
T1) Surgery with Anesthesia, T2) Burdizzo
T3) Rubber ring, T4) Surgery plus anti- inflammatory
T5) Traditional surgery

After 2 aging days, meat redness was lower in beef coming from Traditional surgery castrated animals, than in all other Treatments (p<0,05; Table 2). Brightness did not show any difference between Treatments at this moment (p>0,05).

Table 2. Meat Luminosity and redness with 2 and 14 days of aging.

Meat color	T1	T2	T3	T4	T5
L*2 days	36,1	35,7	37,1	35,2	33,2
a* 2 days	$20,9^{a}$	$19,9^{a}$	$20,4^{a}$	$19,1^{a}$	$14,4^{b}$
L* 14 days	$36,5^{a}$	$36,4^{a}$	$34,9^{ab}$	$34,4^{ab}$	$32,3^{b}$
a* 14 days	$18,0^{a}$	$16,1^{ab}$	$15,4^{ab}$	$15,2^{ab}$	$14,0^{b}$

Treatments with different letter in the same line, differ with p<0.05
T1) Surgery with Anesthesia, T2) Burdizzo
T3) Rubber ring, T4) Surgery plus anti- inflammatory
T5) Traditional surgery

After 14 days of aging, Brightness was lower in beef coming from Traditional surgery castrated animals, when compared to meat coming from Surgery with Anesthesia and Burdizzo castrated animals. Also redness was lower in Traditional surgery when compared to Surgery with anesthesia (p<0,05; Table 2).

pH and Shear force did not differ between Treatments at any aging time (p>0,05; Table3). However only meat from T2 steers had tender meat (3,9 kg) with 14 days of aging.

Table 3.pH values and shear force with 2 and 14 days of aging.

pH and Shear force (kg)	T1	T2	T3	T4	T5
pH 2 days	5,51	5,53	5,53	5,54	5,5
pH 14 days	5,52	5,54	5,55	5,59	5,55
Shear force 2 days	6,4	4,8	5	5,9	5,5
Shear force 14 days	4,9	3,9	4,5	4,6	5,4

Treatments with different letter in the same line, differ with $p<0.05$
T1) Surgery with Anesthesia, T2) Burdizzo
T3) Rubber ring, T4) Surgery plus anti- inflammatory
T5) Traditional surgery

IV. CONCLUSIONS

- Calves castrated with 7 months old and with the evaluated methods, did not show differences in growth and in achieving the slaughter point.
- Brightness and redness were lower in meat coming from animals castrated by Traditional surgery without pain mitigation, when compared to meat coming from animals that local anesthesia was used before surgery.
- The evaluated castration methods did not determine differences in carcass final pH nor in shear force values.
- Considering that carcass and meat quality traits were not mainly affected by the castration methods evaluated, animal welfare criteria should be determinant when choosing the best method to be performed with 7 month old calves.

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