EFFECT OF CASTRATION TIME ON FEEDLOT PERFORMANCE, CARCASS CHARACTERISTICS, AND BEEF TENDERNESS

J. W. Homm, T. T Marston, J. A. Unruh, and J. R. Brethour

Summary

Crossbred Angus calves (n=120) were randomly assigned to early-castrated, early-castrated plus implant, and late-castrated treatment groups. After weaning, calves were placed on feed at the Western Kansas Agricultural Research Station in Hays, Kansas, for finishing. On-feed weights and final weights were similar among treatments. During the first 132 days on feed, the steers castrated early and implanted had a lower average daily gain than early- and late-castration treatments. Early castrates tended (P=0.08) to have a lower feed-to-gain ratio for the first 132 days on feed. Hot carcass weight, internal fat, and marbling scores were not affected by treatment. Carcasses from steers castrated late had less backfat, larger ribeye areas, and lesser yield grades (greater cutability) than carcasses from steers castrated early, with or without an implant. Carcasses from steers castrated early and implanted had a greater percentage grading USDA choice (60%) than did carcasses from steers castrated early (45%) or late (41%). Warner-Bratzler shear force and sensory-panel traits were similar for all treatment groups.

Introduction

Cow/calf producers have several options for selling their calves. Traditionally, calves have been sold at weaning, sold after a preconditioning period, or retained through the feedlot phase. The time of castration can affect selling weight. Previous research conducted at KSU has shown that early castration plus an implant can increase weaning weights of early castrates to the same weight as late castrates. Little is known, however, about the impact of castration strategy on subsequent feedlot performance, carcass characteristics, and beef tenderness. Therefore, our objective was to determine the effect of castration time on feedlot performance, carcass characteristics, and beef tenderness attributes.

Experimental Procedures

One hundred and twenty male beef calves were randomly assigned to one of three treatments: early castration, early castration plus an implant, and late castration. Early-castrated calves were castrated at approximately 75 days of age (summer grass turnout time) and, within this group, 40 randomly selected calves received a SYNOVEX® C (Ft. Dodge) implant. The remaining 40 calves were castrated on the day of weaning (October 15, 2002) at approximately 220 days of age. Three weeks before weaning, calves were processed with FORTRESS 7® (Pfizer) and CATTLEMASTER 4® (Pfizer). At weaning, calves were given a CATTLEMASTER 4 booster injection, dewormed (DECTOMAX® pour-on, Pfizer), and weighed. After a 28-day postweaning feeding period, all steers were weighed, given a BOVISHIELD 4 injection, and shipped to the Western Kansas Agricultural Research Station in Hays, Kansas, for finishing.

After arrival, all steers were weighed, implanted with SYNOVEX® S (Ft. Dodge), and randomly placed into pens according to treatment. After 64 days on feed, steers were reweighed and reimplanted with SYNOVEX S.

Steers were harvested in two kill groups when ultrasound data showed the greatest probability of grading choice while minimizing the number of USDA yield grade 4 carcasses and before reaching a 950-pound carcass weight. The remaining cattle (second slaughter group) were marketed at the same endpoint. Steers were slaughtered at a federally inspected, commercial packing facility, where carcass characteristics were measured.

Sub-samples of 36 ribs (12 per treatment) were collected from each slaughter group for sensory and Warner-Bratzler shear force (WBSF) analysis. All ribs were aged in vacuum-packaged bags for 14 days postmortem. After aging, ribs were faced and fabricated into two 1-inch thick *longissimus* muscle steaks, starting at the posterior end. One steak was randomly assigned to WBSF and one to sensory-panel evaluation. Steaks assigned to WBSF were cooked fresh immediately after the 14-day aging period. Steaks for sensory-panel evaluation were vacuum packaged and stored at –20ºF until analysis. All steaks were cooked to an internal temperature of 158ºF in a Blodgett dual-air-flow convection gas oven. Steak temperature was monitored by using thermocouples attached to a Doric mini trend. Steaks for WBSF were then stored overnight at 37ºF, before eight 0.5-inch diameter cores were taken parallel to muscle fibers and sheared perpendicular to muscle fibers with a WBSF attachment on a Universal Instron.

Steaks for sensory-panel analysis were thawed for 24 hours at 37ºF and cooked by using the same procedures as steaks for WBSF measurements. Cooked steaks were cut into 0.5 x 0.5 inch cubes and placed in pre-heated double boilers. Sensory-panel trials were conducted in individual booths with a mixture of red and green lighting. Duplicate samples were presented to trained panelists in random order. Samples were evaluated for five sensory attributes by using an eight-point numerical scale, and were scored to the nearest 0.5. Traits assessed were: myofibrillar tenderness (1=extremely tough, 8=extremely tender), connective tissue amount (1=abundant, 8=none), overall tenderness (1=extremely tough, 8=extremely tender), juiciness (1=extremely dry, 8=extremely juicy), and beef flavor intensity (1=extremely bland, 8=extremely intense).

Feedlot performance data was analyzed as a one-way ANOVA, and differences were separated by using the Least Squares Means procedure in SAS. All carcass and WBSF data were analyzed as a completely randomized block design, with the slaughter date serving as the block. Sensory-panel data were analyzed as a completely randomized block design, with panel within a slaughter group serving as the block.

Results and Discussion

Effect of castration time on feedlot performance is presented in Table 1. During the first 132 days on feed, the steers castrated early and implanted had ($P<0.05$) poorer daily gains than the early- or late-castrated steers. The second slaughter group was left on feed for 48 days after the first slaughter group. During this period, daily gain was similar ($P>0.05$) among treatment groups. However, these gains were greater than that during the feeding period when both slaughter groups were combined. We speculate that this result was caused by slaughtering the early-maturing, slower-gaining cattle in the first slaughter group. The early-castration group tended ($P=0.08$) to have a smaller feed-to-gain ratio during the first 132 days on feed. The feed-to-gain ratio for the last 48 days on feed for the second slaughter group was smaller than for the first 132 days on feed that included both slaughter groups. Again, this may be because of slaughtering the earlier-maturing, less efficient cattle in the first slaughter group.

Effects of castration time on carcass characteristics and meat quality are presented in Table 2. Hot carcass weight, internal fat, and marbling scores were not affected (P>0.05) by castration treatment. Carcasses from late-castrated steers had (P<0.05) less backfat, larger ribeyes, and lesser yield grade numbers (greater cutability) than carcasses from both early-castration groups. Even though marbling was similar (P>0.05) for all treatment groups, the carcasses from steers castrated early and implanted seemed to have the greatest percentage of USDA Choice carcasses. All sensory-panel scores and WBSF traits of carcasses were similar (P>0.05) for all castration groups.

Previous research indicated that weaning weights for intact bulls (or castrates at weaning) and early castrates having implants were similar, and greater than early castrates with no implant. The group of cattle that were castrated early and implanted had calves with the greatest dollar value at weaning, when compared with castration at weaning because of post-castration weight loss.

This research extends the previous work by following these calves through the feedlot phase. If a producer retains ownership through the feedlot, late castration may increase cutability (reduce yield grade number) by decreasing backfat and increasing ribeye area. This could be advantageous for cattle marketed on a grid that emphasizes cutability. However, cattle castrated early and implanted seemed to have the greatest percentage of USDA Choice carcasses, indicating potential benefits when marketing on a grid that emphasizes quality. Also, calves castrated early do not suffer the post-weaning weight losses caused by castration at weaning.

Table 1. Effect of Castration Time on Feedlot Performance

Item	Early Castration	Early Castration Plus Implant	Late Castration	Standard Error
On-feed weight, lb[a]	626	624	611	7.4
Final weight, lb[b]	1243	1215	1222	103.8
Feedlot daily gain, lb				
0 to 132 days on feed	3.8[d]	3.6[e]	3.8[d]	0.06
133 to 181 days on feed	4.6	4.6	4.2	0.18
Feed-to-Gain Ratio[c]				
0 to 132 days on feed	5.8	6.4	6.1	0.20
133 to 181 days on feed	5.7	5.3	5.5	0.13

[a]On-feed weights were taken on November 21, 2002.
[b]Final weights were taken before two kill dates (4/2/03 and 5/22/03).
[c]Feed is on dry matter basis.
[de]Means within a row and having different superscripts differ (P<0.05).

Table 2. Effects of Castration Time on Carcass Characteristics and Meat Quality

Item	Early Castration	Early Castration Plus Implant	Late Castration	Standard Error
Hot carcass weight, lb	775	767	768	46.9
Back fat, inches	0.67[e]	0.69[e]	0.60[d]	0.022
Ribeye area, sq. inches	12.3[d]	12.4[d]	12.8[e]	0.74
Internal fat, %	2.8	2.7	2.8	0.06
USDA Yield Grade	3.8[e]	3.7[e]	3.4[d]	0.08
Marbling[a]	40.3	40.8	39.9	1.59
USDA Choice, %	45	60	41	–
WBSF[b]	8.6	9.0	8.6	0.29
Sensory Panel[c]				
Myofibrillar Tenderness	5.7	5.8	5.8	0.09
Connective Tissue	7.0	7.0	6.9	0.06
Overall Tenderness	5.9	6.0	5.9	0.09
Juiciness	5.7	5.8	5.9	0.05
Flavor	5.9	5.9	5.9	0.04

[a]Marbling scores (30=Slight zero, 40=Small zero).
[b]Warner-Bratzler Shear Force (lbs peak force).
[c]Sensory-panel evaluations were scored on an eight-point scale; (myofibrillar and overall tenderness 1=extremely tough, 8=extremely tender; connective tissue 1=abundant, 8=none; juiciness;1=extremely dry, 8=extremely juicy; flavor, 1=abundant, 8=none).
[de]Means within a row and having different superscripts differ ($P<0.05$).