EFFECTS OF AGE-CLASS AND IMPLANT PROTOCOL ON HOLSTEIN STEER CARCASS DESIRABILITY

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Story In Brief

Ten Holstein steer carcasses were selected from each of three treatment groups (calf-fed, aggressively implanted = CA; calf-fed, normally implanted = CN; yearling-fed, normally implanted = YN) at a commercial meat packing facility. Complete quality and yield grade data were collected and the left side of each carcass was fabricated and trimmed into boneless subprimals to determine compositional differences at three levels of fat trim (.75, .25, .00 in.). Ribeye, top sirloin butt, and top round steaks were removed, aged for 14 days, and evaluated for tenderness. Carcasses from aggressively implanted, calf-fed Holstein steers were more advanced in maturity and had the least marbling. Furthermore, this treatment group had the highest incidence of dark cutting carcasses (personal observation). Carcasses from normally implanted, calf-fed Holsteins tended to have the most marbling, smallest ribeyes, highest numerical yield grades, and the most trimmable fat (0.25 and 0.0 in. levels). Yearling-fed, normally implanted Holsteins produced carcasses that tended to have the largest ribeyes (despite similar carcass weights), most desirable yield grades, and the least trimmable fat. No significant differences in boxed beef, lean trim, or bone yields due to age or implant were detected. However, in comparison with HRI carcasses (traditional beef breeds), Holsteins had less trimmable fat and lower boxed beef yields as well much higher percentages of bone. No significant differences were noted for shear force (tenderness) values of ribeye, top sirloin butt, or top round steaks, although variability in tenderness tended to be highest for top butt and top round steaks from aggressively implanted, calf-fed steers.

(Key Words: Implants, Holstein, Tenderness, Yields, Beef.)

Introduction

Holstein steer beef has attracted increased national attention by the retail meat industry due to the leanness of these carcasses which coincides with consumer preference. Holstein meats comprise approximately 15% of total beef consumption in the United States (Buege, 1990) and, as a result of their

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attractiveness to consumers (Callow, 1962), increasing the percent edible portion from Holstein steer carcasses could benefit the meat industry. Results from the National Tenderness Survey (Morgan et al., 1991) indicated tenderness varies widely among retail beef steaks. This inconsistency may be due partially to the diversification of the U.S. cattle population during the past two decades. The majority of Holstein steers are sired by a limited number of genetically-related bulls; accordingly, meat from Holstein steers may have increased consistency while remaining acceptable in sensory attributes.

In the United States, implants have been used commercially for over 30 years. Extensive research has shown implants increase average daily gain, improve feed efficiency, and often increase muscle mass of beef cattle. Apple et al. (1991) showed Holstein steers respond similarly to beef breeds when implants are used and indicated tenderness values of steaks were not affected by implanting. However, due to limited information on implant protocol and age differences in Holstein steers, the objectives of this study were twofold: 1) to examine the effect of implant protocol on carcass grade traits as well as boxed beef subprimal yields at three fat trim levels (1.0, 0.5, and 0.00 inch) and two age classes and 2) to examine possible differences in steak tenderness relative to implant treatment protocol and age differences.

Materials and Methods

Ten Holstein steer carcasses from each of three treatment groups (calf-fed, aggressively implanted = CA; calf-fed, normally implanted = CN; yearling-fed, normally implanted = YN) weighing approximately 760 pounds were selected at a commercial meat packing facility. Selection criteria included carcass weight (700 to 800 lb.), quality grade within each treatment lot (% Choice vs. % Select), and minimal dressing defects. Complete quality and yield grade data were collected on each carcass approximately 24 hours postmortem.

The left side of each carcass (10 per treatment) was fabricated into boneless subprimals to determine compositional and value differences at three levels of fat trim (.75, .25, .0 in.). Sides were initially fabricated into the major wholesale cuts (round, loin, rib, chuck) and subsequently into boneless subprimals to determine boxed beef yield. Percentages were calculated using aggregate side weight.

Sections of three subprimals removed from each side were shipped to the Oklahoma State University Meats Laboratory where 1.0 inch thick steaks were cut representing the ribeye, top sirloin butt, and top round subprimals. Steaks were vacuum packaged, aged for 14 days, and subsequently frozen (-22^{o}F). Steaks were later thawed at 36^{o}F for a period of 24 hours and cooked to a medium degree of doneness (158^{o}F) using an impingement oven. Upon cooling to room temperature, an average of six 0.5 inch diameter cores were removed for shear force measurement using an Instron Warner-Bratzler instrument.

Statistical analyses were conducted using analysis of variance and Tukey's Studentized Range Test to separate means. Contrasts were conducted for effect of age with a normal implanting scheme (NY); normal compared to aggressive implanting (NA); and comparison of normal yearlings with aggressively implanted calves (YA). Significance was reported at the $P<.05$ level.

Results and Discussion

Carcass yield grade traits are reported in Table 1. No significant differences were observed among treatment groups for preliminary yield grade (external fatness) or percentage internal fat. Ribeye area was significantly greater for carcasses from yearlings than for calves while yearlings had greater ribeye areas per hundred pounds of carcass than normal calf-feds. Correspondingly, yearling steers had significantly lower numerical yield grades than calf-feds.

All maturity scores for these Holstein steers were well within the “A” maturity classification (USDA, 1989). However, aggressively implanted, calf-fed Holsteins produced carcasses with more ($P<.05$) advanced skeletal and overall maturity scores than normally implanted, calf-fed or yearling-fed Holstein steers. Care was taken during carcass selection to avoid carcasses with dark cutting characteristics, because aggressively implanted, calf-fed steers often had a higher incidence of dark cutting carcasses. Hence, no differences were noted among treatment groups in lean maturity. CN steers produced the highest percentage of U.S. Choice carcasses. However, all treatment groups averaged a “small” degree of marbling, the minimum requirement for the U.S. Choice quality grade (USDA, 1989).

Percentages of fat trim, bone, and boxed beef yield are presented in Figures 1, 2, and 3, respectively. For comparison with yields from Holsteins in this study, fabrication data from 38 traditional beef carcasses (similar in yield grade) collected in another study and designated as HRI (hotel, restaurant, and institutional trade) are included. As Figure 1 depicts, when fat was trimmed from boneless subprimals and wholesale cuts to achieve .75, .25, and .00 inch fat trim levels, the percentage fat trim increased. Coincidentally, no significant differences among treatment groups for percentage fat trim were discovered at the .75 inch trim level. However, carcasses from CN and CA steers had significantly higher percentages of fat trim at both the .25 and .00 inch levels than carcasses from YN steers. CA carcasses fell between these groups being intermediate at all fat trim levels. HRI beef carcasses had higher percentages of fat trim when compared to Holsteins, regardless of trim level.

Bone yields (Figure 2) were similar (P>.05) for all Holstein treatments being approximately 2.8% higher than traditional HRI beef carcasses. No significant differences were noted for boxed product percentage yields among Holstein carcasses regardless of fat trim endpoint; however, YN Holstein carcasses produced the highest numerical values (Figure 3). Lean trim (75:25 plus 50:50 lean:fat) yields are not included in boxed product percentages; lean trim yields at the 0.75 inch fat trim end point were 21.2, 21.4, and 21.7 and 11.0% for CN, CA, YN, and HRI carcasses, respectively.

The most impressive difference noted in Figure 3 is the comparison of HRI beef carcasses with Holstein carcasses. HRI carcasses yielded 12.0, 6.8, and 6.9% more boxed product than Holstein carcasses at the 0.75, 0.25, and 0.00 inch fat trim levels, respectively. This, coupled with lower bone percentages, gives carcasses from traditional beef breeds a decisive advantage in muscle-to-bone ratio (2.5:1, 2.6:1, 2.5:1, vs 3.5:1 for calf normal, calf aggressive, yearling normal, and HRI beef carcasses, respectively). Hence, this difference in boxed beef yield supports a price discount assigned to Holstein carcasses.

Tenderness values for steak treatment groups are reported in Table 2. No (P>.05) differences in mean tenderness values were noted among steaks of similar type. Interestingly, tenderness values for these Holstein carcasses were highest for ribeye steaks (least resistance to shear), intermediate for top round steaks, and lowest for top sirloin butt steaks; this differs slightly from reports regarding steaks from traditional beef breeds (Morgan et al., 1991) for which top sirloin butt steaks were more tender than top round steaks. Differences in steak thickness could explain this discrepancy. Top round steaks in our study were cut 1.0 inch thick; perhaps thick steaks respond differently to slower cooking than the 0.3 to 0.4 inch thick steaks used in the National Beef Tenderness Survey. The most notable trend relative to treatment groups was the variability in shear force among top butt and top round steaks; aggressively implanted Holstein calves tended to be more variable in tenderness than normally implanted Holstein calves and yearlings.

Implications

Among calf-feds, aggressive implanting resulted in similar boxed beef yields as normal implanting. Calf-fed Holstein steers had greater fat thickness and significantly more trimmable fat than carcasses from Holstein steers fed as yearlings. In this study, advancing the age of Holstein steers while following a normal implant schedule tended to increase ribeye area and decrease the percentage of trimmable fat. Compared with carcasses from beef breeds, Holstein carcasses produced a lower percentage of trimmable fat; however, they had higher percentages of bone and lower boxed beef yields.

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Table 1. Carcass maturity, marbling, and yield grade values stratified by treatment group.

Item	Calf normal	Calf aggressive	Yearling normal	Effect[d]
Carcass weight, lb	763.5	764.8	759.0	
Carcass maturity[a]				
Skeletal	A57	A82	A48	NA, YA
Lean	A60	A63	A62	
Overall	A59	A73	A55	NA, YA
Marbling score[b]	Sm72	Sm03	Sm39	NA
% U.S. Choice	100.0	50.0	50.0	
Preliminary yield grade	2.7	2.6	2.6	
Ribeye area, sq in	11.0	11.7	12.2	NY, YA
Ribeye area/cwt[c]	1.4	1.5	1.6	NY
KPH, %	2.2	2.3	2.3	
Yield grade	3.0	2.7	2.5	NY, YA

[a] Carcass maturity scores: A = approximately 9 to 30 months of chronological age at slaughter (USDA, 1989).

[b] Marbling score: Sm00 = small amount, the minimum required for U.S. Choice.

[c] Ribeye area/cwt = ribeye area/(carcass weight/100).

[d] Contrast effects:
NY = calf normal versus yearling normal;
NA = calf normal versus calf aggressive;
YA = yearling normal versus calf aggressive.

Table 2. Shear force values and standard deviations for Holstein ribeye, top round, and top butt steaks stratified by treatment group.

Item	Calf normal	SD	Calf aggressive	SD	Yearling normal	SD
Shear force, lb[a]						
Ribeye	7.8	1.2	7.7	0.8	8.1	0.9
Top round	8.9	1.3	9.7	1.8	9.5	1.3
Top butt	10.9	1.3	11.5	2.0	11.8	1.3

[a] Based on shear force: very tender = 8.5 lb or less; tender = 8.6 to 10.0 lb; tough = greater than 10.0 lb. P>.05 for all comparisons.