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TIME OF IMPLANTING PRIOR TO HARVEST EFFECTS ON MEAT TENDERNESS

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Story in Brief

The effect of implant timing and its effect on meat tenderness was measured using 100 crossbred yearling steers. Cattle were blocked into five pens, each being assigned a treatment of either 1) no implant during finishing period, 2) one implant of Revalor-S© (Rev-S) on d 0, 3) implant on d 0 with removal of implant on d 56, followed by a second administration of an additional Rev-S, 4) implant on d 0 with removal of implant on d 84, followed by a second administration of an additional Rev-S, 5) implant on d 0 with removal of implant of d 112, followed by a second administration of an additional Rev-S and each pen was fed a corn based diet for 140 d. After the cattle were harvested, carcasses were chilled for 48 h, graded, and the longissimus thoracis was removed. Steaks were aged to either 7, 14, or 28 d and then broiled to obtain shear force values. Overall, meat tenderness was not affected by implant treatments, however aging did have an effect on tenderness. Shear force means were highest after 7-d aging with significant reductions after 14 d and 28 d. No interaction was apparent between implant treatments and aging periods.

Key Words: Implant Timing, Postmortem Aging, Tenderness, Beef

Introduction

One of five consumers has a negative experience when purchasing beef and approximately 542 consumers could be affected by steaks and roasts fabricated from a single beef carcass (NCA, 1994). Consumer, purveyor, and retailer acceptability of beef products is related to meat tenderness, therefore it should be of high priority to cattle producers (NCA, 1995). Production practices such as implanting beef may be negatively associated with meat tenderness discouraging their use regardless of their cost effectiveness. Of 29 trials comparing implanted with non implanted cattle, higher shear force values from implanted animals were only realized in five of these comparisons (Duckett et al., 1997). Evaluation of implant treatments in conjunction with postmortem meat aging periods will assist the beef industry to produce products more consistent in eating quality. The objective of this study was to determine 1) if various implant treatments positively or negatively affect meat tenderness, and 2) the effects of aging periods on tenderness.

Materials and Methods

Angus x Senepol yearling steers (n=100, ~729 lb), previously never implanted, from the Kerr Center for Sustainable Agriculture, Inc., were weighed, blocked and placed into 20 groups. Steers were fed a high concentrate diet for approximately 140 d. Each pen was randomly assigned one of five implant treatments.

Implant Protocol. Treatments were 1) no implant at any time during the finishing period (negative control), NC; 2) a single combination implant (trenbolone acetate and estradiol = Rev-S) on d 0 in the left ear (R_0); 3) initial implant of Rev-S on d 0 in the left ear, removal of that implant on d 56, followed by a second administration of Rev-S in the right ear (R_{56}); 4) initial implant of Rev-S on d 0 in the left ear, removal of that implant on d 84, followed by a second administration of Rev-S in the right ear (R_{84}); 5) initial implant of Rev-S on d 0 in the left ear, removal of that implant on d 112, followed by a second administration of

Rev-S in the right ear (R_{112}).

Harvesting and Fabrication. Steers were transported to a commercial processing facility in southwestern Kansas, harvested, and carcasses were chilled at approximately 0° C for approximately 36 h. After USDA quality and yield grade traits were collected (for complete details see Gardner et al., 1999), the *longissimus thoracis* muscle from the left side of each carcass was removed and transported to Oklahoma State University for further fabrication. Three steaks (each 1 in thick) were removed from each posterior portion of each longissimus section, vacuum packaged, aged at 2° C for 7, 14, or 28 d, blast frozen for 24 h, and stored at □17.8° C.

Tenderness Assessment. Prior to cooking, steaks were randomized, assigned to one of three cooking days and thawed on steel metal trays for 24 h at 4° C. An impingement oven was used to broil steaks to an internal temperature of 70° C. Steaks were then cooled to room temperature (22° C) before extracting six core samples (0.5 in diameter) per steak. Cores were extracted parallel to the longitudinal direction of the muscle fibers and shear force values were determined using an Instron Universal testing machine equipped with a Warner-Bratzler attachment.

Statistical Analysis. Data consisting of 93 observations were analyzed for the effects of implant treatment and postmortem aging period on meat tenderness. A split plot procedure was used to determine postmortem aging and treatment effects on tenderness and shear force least squares means were compared for treatment groups. Frequency percentages were computed for each aging period in three shear force ranges. Shear force ranges were set at Tender 1 (Tend 1) = < 8.5 lb, Tender 2 (Tend 2) = 8.5 to 9.99 lb, and Tender 3 (Tend 3) = > 9.99 lb. Probabilities and percentages reported were produced by SAS (SAS, 1985).

Results and Discussion

Carcass characteristics and shear force values are reported in Table 1. Steak tenderness was not affected regardless of implant treatments (P=0.08), however, aging periods (P<0.0001) did enhance tenderness (Figures 1 to 3). As aging periods increased, shear force values decreased. The interaction between implant treatment and aging period (P<0.17) was nonsignificant. The frequency of steaks aged 7 d in Tender 1, 2, and 3 was 49%, 22%, and 22%, respectively; while steaks aged 14 d were 70%, 20% and 3%, respectively. Steaks aged 28 d had the highest frequency in Tender 1 (87%) and the lowest in Tender 2 and 3 (4 and 2%, respectively). Percentages of steaks aged 7, 14, and 28 d from each implant treatment in the three shear force parameters are shown in Figures 1 through 3. Although no differences in shear force values were found among treatments, aging period significantly increased the number of steaks classified as Tender 1.

In this study, cattle were not at risk of producing tough longissimus steaks due to implant effects if proper postmortem aging was controlled. Carcasses having shear force values less than 8.5 lb are considered tender while those that exceed 10.0 lb are considered tough. To reduce risk of tough meat, carcasses should be aged between 14 and 28 d for best results.

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Acknowledgments

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Table 1. Least squares means for carcass characteristics blocked by implant treatment for steers fed 140 d.

	Implant treatment[a]					
Item	Control	R_0	R_{56}	R_{84}	R_{112}	SE
Weight, lb						
Initial	736	730	734	735	740	6.94
Final	1060	1204	1206	1207	1202	19.23
Hot carcass wt, lb	648	735	733	737	738	10.89
Dressing percentage	61.1	61.0	60.8	61.0	61.5	.43
Adj. fat thickness, in	.55	.62	.60	.59	.63	.07
Ribeye area, in^2	11.1	12.4	12.6	12.1	12.7	.28
KPH, %	2.8	2.4	2.4	2.4	2.4	.14
Yield grade	3.38	3.35	3.22	3.39	3.29	.11
Overall maturity[b]	A^{35}	A^{47}	A^{47}	A^{51}	A^{48}	2.15
Marbling score[c]	Sl^{96}	Sl^{74}	Sl^{87}	Sl^{59}	Sl^{87}	13.37
Quality grade						
Prem Choice[d], %	13.3	-	5.0	-	10.0	5.00
Low Choice[e], %	28.3	21.3	30.0	22.5	25.0	11.47
Select, %	58.3	78.8	60.0	72.5	65.0	14.88
Standard, %	-	-	5.0	5.0	-	3.16
Yield grade						
2, %	15.0	10.0	25.0	25.0	30.0	9.04
3, %	66.7	72.5	75.0	57.5	70.0	9.76
4, %	18.3	17.5	-	17.5	-	8.08
Shear Force, lb						Mean
7 d	8.33	9.08	9.41	9.37	8.86	9.02[f]
14 d	7.58	7.56	7.78	7.76	7.78	7.69[g]
28 d	6.42	6.92	6.44	6.53	6.53	6.57[h]
Mean	7.45	7.85	7.87	7.89	7.72	
Standard Deviation						

7 d	.70	1.19	1.01	.91	.64	
14 d	.61	.63	.86	.52	.46	
28 d	.35	.56	.45	.51	.45	

[a]Implant regimen: Control=never implanted; R_0=a single implant of Rev-S on d 0; R_{56}=initial implant of Rev-S on d 0, removal on d 56 and a second Rev-S; R_{84}=Rev-S on d 0, removal on d 84, second Rev-S; R_{112}=Rev-S on d 0, removal on d 112, second Rev-S.

[b]Maturity score: "A", between approximately 9 and 30 mo of age.

[c]Marbling score: Sl = "slight[oo]", the minimum required for U.S. Select.

[d]Prem Choice = Modest[oo] to Moderate[99] marbling (Average and High Choice). [e]Low Choice = Small[oo] to Small[99] marbling.

[f,g,h]Means with different superscripts differ (P<.05).

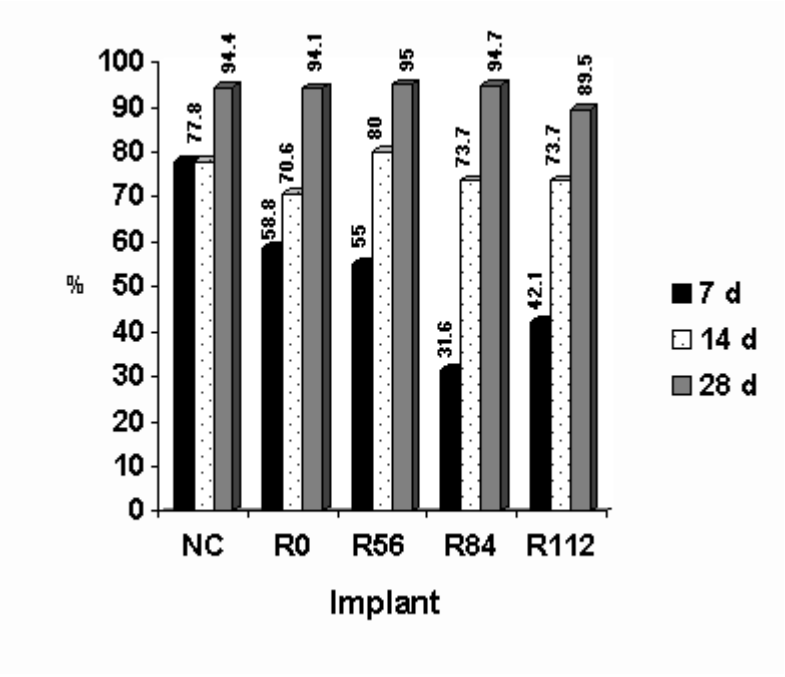

Figure 1. Percentages of steaks having shear force values less than 8.5 lb stratified by implant treatment and postmortem aging period.

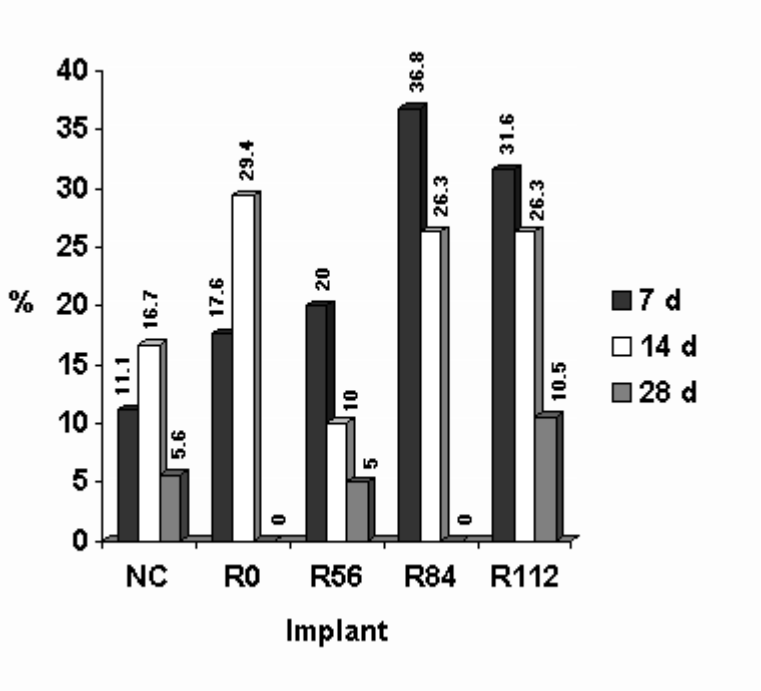

Figure 2. Percentages of steaks having shear force values between 8.5 and 9.99 lb stratified by implant treatment and postmortem aging period.

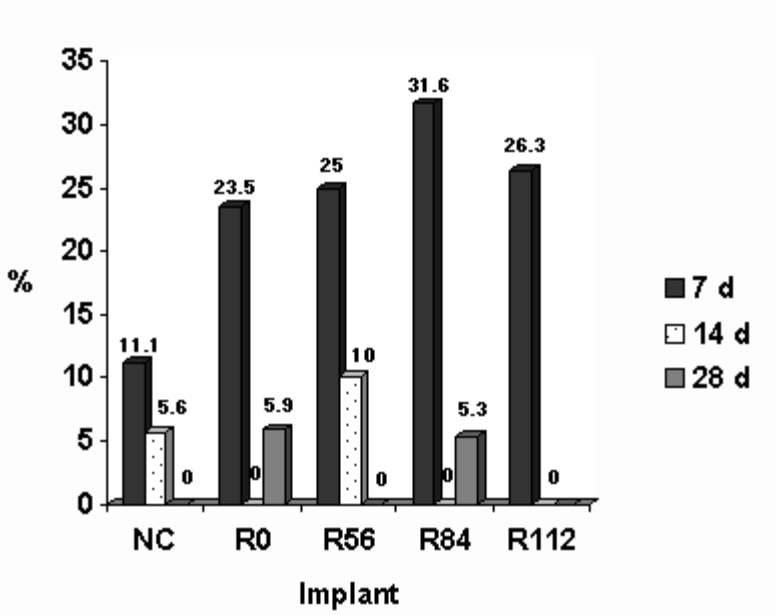

Figure 3. Percentages of steaks having shear force values 10.0 lb or more stratified by implant treatment and postmortem aging period.

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