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GROWTH IMPLANTS AFFECT TENDERNESS OF BEEF STEAKS.

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ABSTRACT: Two experiments were designed to evaluate the effect of growth implants on the carcass characteristics, and tenderness of cattle with different genetic growth potentials. The first experiment evaluated Angus steers (128) from sires with high EPD's for retail product yield (n=64) or marbling (n=64). Implant treatment (with, without) were imposed randomly within sire groups. Steers were harvested following normal industry practices when ultrasound measure determined that 75% of the steers were USDA Choice. Carcass data was collected. Loins (IMPS 180) were collected from each carcass. Loins were cut into 1.3 inch steaks and frozen after 7, 14 and 21 days. The second experiment evaluated steers and heifers of British (n=34) and Continental (n=46) breed descent. Heifers and steers from both breed combinations were assigned to implant treatments. Steers and heifers were harvested following normal industry procedures after they had been on feed for 120 days. Carcass data was collected. Loin sections (3 inches) were cut into one 1.3 in steak for tenderness analysis. Eight to ten samples for shear force evaluation were removed from each cooked steak and sheared once perpendicular to the fiber. Individual animals were utilized as the experimental unit with planned comparisons used to compare growth potential, sex or implant treatments. Using growth implants significantly reduced the tenderness of steaks regardless of the growth potential or sex of the animal. Steaks from heifers were less tender than steers and steaks from Continental breeds were less tender than those from British breeds. There was a trend (P=0.26) suggesting that the tenderness of steaks from Continental breed steers and heifers were affected more by the use of growth implants than those from British breeds. Use of implants does decrease the tenderness and may contribute to added tenderness variability because of the different responses observed between heifers and steers, and different growth potentials.

Keywords: growth implants, beef, tenderness

Introduction

Growth implants are routinely used to improve efficiency of meat production by improving red meat yield. Increased feed efficiency and increased longissimus muscle area have been reported with use of hormonal implants

To accomplish muscle growth, protein accretion must exceed protein breakdown. The enzyme system that is partially responsible for controlling protein accretion and breakdown is the calpain system (Boehm et al., 2000). Testosterone increases the activity of calpastatin (inhibitor of calpain) and increases protein accretion. Use of exogenous growth hormones in implants increase growth and therefore affect the calpastatin activity. Decreased calpastatin activity postmortem has been linked to increased tenderness. Roeber et al (2000) and Platter et al (2003) reported that steaks from implanted steers had significantly higher Warner-Bratzler shear values than steaks from steers that were never implanted. Platter et al. (2003) also reported that the closer the implant was applied to slaughter, the more likely shear values were to be affected.

Work reported by Platter and co-workers (2003) utilized steers with various genetic backgrounds, but did not analyze to determine if a compounding affect on tenderness is observed when implants were administered to animals with a genetic propensity for greater growth. Late maturing, heavily muscled animals already have a larger rate of protein accretion with reduced degradation (increased calpastatin activity) than earlier maturing light muscled animals. Growth implants increase the rate of growth and may compound any tenderness problems created by growth implants. The current studies evaluate the affect of growth implants on the carcass characteristics, and tenderness of steers with different genetic potential for growth or marbling.

Materials and Methods

Experiment 1

Steers (64) from sires with high EPD's for retail product yield (low yield grades) and high marbling (64) were assigned to an implant protocol (implanted or not implanted) on entry into the feedlot in two different years. Cattle were harvested when ultrasound indicated that the majority of the steers had reached low USDA Choice or greater.

Steers were shipped (9 h with 12 h rest period) to a commercial processing facility where they were harvested following normal industry procedures. Carcass data was collected including hot carcass weight, fat thickness, ribeye area, internal fat percentage and marbling scores by trained university personnel. Loins (IMPS 180) were collected from each carcass. These sections were transported (4ºC) to Montana State University. Striploins were cut into three 3.3 cm steaks. Steaks were aged for 7, 14 or 27 days at 4ºC and then frozen at –20°C until cooked for tenderness analysis.

Experiment 2

Steers and heifers of British (n=34) and Continental (n=46) breed descent were assigned to implant treatments. Implants were a combination implant containing estradiol benzoate (24 mg) and trenbolone acetate (120 mg). After steers and heifers had been on feed for 120 days, they were shipped to a commercial processing facility (8 h with 12 h rest) and harvested following normal industry procedures. After 24 h at 4ºC, carcass data was collected by experienced university personnel, including hot carcass weight, fat thickness, ribeye area, internal fat percentage and marbling scores. Loin sections (7.62 cm) were removed from each carcass. The loin sections were cut into one 3.3 cm steak for tenderness analysis.

Tenderness analysis

Steaks were thawed at 4°C for 24 hours. Each steak was weighed before and after cooking to determine cook loss. Eight to ten samples (1.27 x 1.27 x 2.54 cm) for shear force evaluation were removed from each steak parallel to the fiber direction. Samples were sheared once perpendicular to the fiber direction with a TMS 30 Food Texturometer fitted with a Warner-Bratzler shear attachment. The average of the samples sheared was used for statistical analysis.

Statistics

Individual animals were used as the experimental unit in both studies. The GLM procedure of SAS was used to analyze carcass and tenderness data. Planned comparisons between implant strategy (implant versus no implant) and genetic classifications (high retail product versus high marbling) or implant strategy, sex and growth potential were done.

Results and Discussion

Growth implants used in Angus steers significantly affected carcass traits and shear force values. When implants were used hot carcass weight and ribeye area increased but fat depth and internal fat was not affected. In addition, shear force values were significantly higher ($P < 0.05$) for steaks that were from implanted steers (Table 1). No interaction was observed between sire type (high retail product, high marbling) and use of implant for carcass traits or shear force values.

When growth implants were administered to steers and heifers with different growth potentials, similar results were seen. Growth implants increased hot carcass weight and LD area, decreased internal fat and yield grade whereas fat depth was not affected. Steaks from steers and heifers that had been implanted had significantly ($P < 0.05$) higher shear force values than did steaks from steers and heifers that were not implanted (Table 2).

Sex and breed also influenced some carcass traits and shear force values. Steer carcasses were heavier with larger LD area than heifer carcasses. In addition carcasses from animals of Continental descent were heavier, with larger LD area, less external fat and lower yield grade. Shear force was significantly lower ($P < 0.05$) for steaks from steers than steaks from heifers. Furthermore, shear force was significantly lower ($P < 0.05$) for steaks from steers and heifers of British decent when compared to steers and heifers of Continental descent. This information along with increased hot carcass weight and LD area of Continental cattle would suggest that increased growth rate might have some impact on tenderness. However, heifers normally grow slower than do steers thus steaks from heifers should be more tender. However the data reported herein does not support this assumption. Also, no significant interaction was seen between growth implant and breed or between growth implant and sex. Growth implants administered to continental steers and heifers did however, have a much greater numeric increase in shear force values than when administered to steers and heifers of British breed decent (Table 2).

References

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Table 1. Effect of sire type and implant strategy on carcass characteristics of Angus steers

		Hot carcass, kg	LD area, cm^2	Fat depth, cm	KPH, %	Yield Grade	Marbling[a]
Sire type[b]	Marbling	324.8	71.5	1.3	2.0	3.5	535
	Retail product	322.3	72.7	1.2	2.0	3.3	484
P =		0.8693	0.5163	0.1500	0.6716	0.0859	0.0002
Implant	With	334.7	74.7	1.3	1.9	3.4	490
	Without	312.2	70.0	1.3	2.1	3.4	580
P =		<0.0001	<0.0001	0.0904	0.0011	0.7839	<0.0001
Sire type × Implant	Marbling with	345.0	76.1	1.4	2.0	3.5	485
	Retail product with	342.2	78.5	1.3	2.0	3.2	459
	Marbling without	325.5	70.3	1.4	2.1	3.6	589
	Retail product without	311.1	70.3	1.2	2.1	3.4	552
P =		0.2127	0.4119	0.3858	0.3577	0.9850	0.7959

[a]200 to 299 = Traces; 300-399 = Slight; 400-499 = Small; 500-599 Modest.
[b]Sires were selected for high expected progeny differences for retail product yield or marbling.

Table 2 Effect of sire type, implant strategy and ageing on the tenderness of beef top loin steaks.

		WBS, kg
Sire type[a]	Marbling	5.5
	Retail product	5.4
	P – value	0.9283
Implant	With	5.9
	Without	6.5
	P – value	<0.0001
Ageing	7	6.2
	14	5.8
	21	5.8
	P – value	0.3302
Sire × Implant	Marbling with	6.0
	Retail product with	5.8
	Marbling without	5.0
	Retail product without	5.1
	P – value	0.6385

[a]Sires were selected for high expected progeny differences for retail product yield or marbling.

Table 3 Effect of breed type, sex and growth implants on carcass traits and tenderness.

		Hot carcass, kg	LD area, cm^2	Fat depth, cm	KPH, %	Yield Grade	Marbling[a]	WBS, kg
Breed type[b]	Continental	294.8	75.5	0.8	1.8	2.2	389	7.9
	British	320.8	82.6	0.9	1.9	2.5	388	6.7
	P – value	<0.0001	0.0001	0.0001	0.4687	0.0002	0.9812	0.0060
Sex	Steer	310.9	78.7	0.8	1.9	2.4	384	6.9
	Heifer	293.9	76.8	0.9	1.9	2.4	393	7.7
	P – value	0.0002	0.0378	0.378	0.5946	0.8244	0.2746	0.064
Implant	With	314.5	81.3	0.9	1.0	2.3	381	7.9
	Without	290.4	74.2	0.9	2.0	2.5	396	6.8
	P – value	<0.0001	<0.0001	0.5978	0.0005	0.0011	0.0556	0.0081
Breed × Sex	Cont. Steer	330.5	83.2	0.7	1.9	2.2	367	7.2
	Brit. Steer	303.0	76.1	0.9	1.9	2.4	388	6.7
	Cont. Heifer	310.0	82.6	0.7	2.0	2.2	394	8.6
	Brit Heifer	286.1	74.5	1.0	1.9	2.5	411	6.8
	P – value	0.8418	0.0544	0.2576	0.8483	0.1847	0.5017	0.1230
Breed × Implant	Continental with	332.6	81.1	0.7	1.8	2.1	371	8.7
	British with	306.3	79.5	0.9	1.7	2.4	381	7.0
	Continental without	308.2	79.4	0.7	2.0	2.4	390	7.1
	British without	282.8	72.0	0.9	2.0	2.6	418	6.4
	P – value	0.8058	0.9281	0.7290	0.8373	0.7910	0.3974	0.2613
Sex × Implant	Steer with	332.2	84.5	0.9	1.7	2.3	365	7.7
	Steer without	289.7	72.9	0.8	2.0	2.5	397	6.2
	Heifer with	296.7	78.7	0.9	1.8	2.3	391	8.0
	Heifer without	291.0	75.5	1.0	1.9	2.5	421	7.3
	P –value	0.0062	0.0086	0.0979	0.0887	0.5302	0.9066	0.3334

[a]200 to 299 = Traces; 300-399 = Slight; 400-499 = Small.

[b]Breed types were characterized by what the sire was known to be. Continental descent cattle were from Simmental sires whereas British descent cattle were from Angus and Hereford sires.