51st International Congress of Meat Science and Technology
August 7-12, 2005 – Baltimore, Maryland USA

HEALTH STATUS EFFECTS ON CARCASS QUALITY AND BEEF TENDERNESS OF FEEDLOT STEERS

D.A. King*[1], F.D. Espitia*[1], C.E. Schuehle[1], R.D. Randel[1], T.H. Welsh, Jr.[1], R.A. Oliphint[1], R.C. Vann[2] and J.W. Savell[1]

[1]*Department of Animal Science, Texas A&M University, College Station, TX 77843, USA*
[2] *Department of Animal Science, Mississippi State University, Brown Loam, MS 39762, USA*

Key Words: Beef; Carcass quality; Health; Tenderness

Introduction

Profitability of feedlot cattle is dependent upon two important factors, production efficiency and carcass quality. Any illness that occurs during the feeding period will influence the animal's behavior resulting in a reduced performance in growth and will further inhibit the overall value of the cattle. In addition to the maintenance costs associated with treating affected animals and reduced productive efficiency, additional losses may be incurred by producers due to the reduced value obtained by the carcass. Evidence from the Ranch to Rail program (Gardner, Doelzal, Bryant, Owens and Smith, 1999) sponsored by Texas Cooperative Extension Service demonstrates this conclusion. This program consisted of 775 head from 74 ranches and analyzed various live animal and carcass characteristics. In this report, it suggests that cattle that have encountered sickness while on feed tended to obtain a greater loss in value and produced fewer carcasses grading U.S. Choice and alternatively produced a greater proportion of cattle grading U.S. Standard.

Gardner et al, (1999) reported that steers that had been treated for Undifferentiated Bovine Respiratory Disease (UBRD) had lower carcass weights and higher percentages of carcasses grading U.S. Standard. Furthermore, these authors reported that animals possessing lung lesions at slaughter had slower daily gains, lighter carcass weights, lower marbling scores, and higher Warner-Bratzler shear force values than those that did not have lung lesions at slaughter. With this information, this investigation was conducted to further investigate the effects of health status during the feeding period.

Objectives

To examine the impact of illness during the feeding period on the carcass quality and the tenderness of the *M. Longissimus lumborum* from feedlot steers.

Methodology

Angus-sired steers (n = 48) were weaned and backgrounded for 40d before being placed in the feedlot for this trial. The steers were from a common herd and possessed

similar genetics and were handled identically to all other cattle at the facility. The cattle were marketed at the end-point determined by the feedlot manager (200 d on feed). During this time, records were maintained for treatments received by the animals. Each animal requiring treatment was subsequently classified in the Treated group (n=10). All remaining animals were classified as Non-treated (n=38). Due to a limited population size, no distinction was made for multiple treatments.

Cattle were processed at a commercial abattoir and carcasses were subjected to high-voltage electrical stimulation. Carcasses were chilled for 48 h in a 0°C cooler with intermittent spray chill for 8 h. Forty-eight h postmortem, carcasses were ribbed at the 12th-13th rib interface and allowed to bloom for at least 15 min before carcass quality and yield grade characteristics (USDA, 1996) were determined. At this time, CIE *L**, *a**, and *b** values were measured. Following grading, carcasses were fabricated and the strip loin was removed from the left side of each carcass.

At 72 h postmortem, the strip loins were sliced into 2.54-cm steaks, which were assigned to laboratory analyses. Calpastatin activity was determined at 72 h postmortem by the protocol of Koohmaraie, Shackelford, Wheeler, Lonergan, and Doumit (1995). Sarcomere length was measured by the method of Cross, West, and Dutson (1981). Additional steaks were assigned to be aged for 14 d and used for Warner-Bratzler shear force determination using the method of McKenna, King, and Savell (2004). Treated and Non-Treated cattle were compared using analysis of variance with the PROC MIXED procedure of SAS (SAS Institute, Cary, NC).

Results & Discussion

The calf-fed steers used in this trial had beginning and final body weights of 291 ± 34 and 580 ± 61 kg, respectively. Initial weight did not differ between the groups. However, the final weight tended (P = 0.06) to be greater in the cattle that remained healthy throughout the feeding period compared to those that required treatment (589 versus 548 kg, respectively). Average daily gain was not affected by health status.

The least-squares means for the carcass characteristics of cattle treated for illness during the feeding period and those not requiring treatment are presented in Table 1.

Table 1. Means for carcass characteristics for steers treated and non-treated for illness during the feeding period

Trait	Treated	Non-treated	$P > F$
Dressing percentage	58.7 ± 0.6	60.1 ± 0.3	0.04
Hot carcass weight, kg	321.9 ± 12.6	354.9 ± 6.1	0.02
Adjusted fat thickness, cm	1.5 ± 0.1	1.8 ± 0.1	0.01
Longissimus muscle area, cm^2	78.1 ± 3.0	83.7 ± 1.4	0.09
Estimated kidney, pelvic, and heart fat, %	2.0 ± 0.1	2.2 ± 0.1	0.11
Yield Grade	3.2 ± 0.2	3.5 ± 0.1	0.11
Marbling score[a]	390.0 ± 29.3	438.9 ± 14.1	0.13
Quality Grade[b]	676.7 ± 14.1	702.9 ± 6.8	0.10

[a]300 = Slight[00]; 400 = Small[00]; 500 = Modest[00]
[b]600 = Select[00]; 700 = Choice[00]

Those cattle that did not get sick during the feeding period and were not treated for illness had greater ($P = 0.05$) dressing percentages and heavier carcass weights than those that were treated. Additionally, the carcasses of the cattle that got sick had less subcutaneous fat as indicated by adjusted fat thickness. Longissimus muscle area tended ($P = 0.10$) to be larger in cattle that did not require treatment during feeding. The finding that healthy cattle had less fat and tended to be more muscular indicates that the cattle requiring treatment were less advanced in their development, conceivably because of gains lost due to illness. Marbling score did not differ with regard to health status. However, the quality grade of the carcasses from cattle treated for illness tended ($P = 0.10$) to be lower than the grades of healthy cattle. The mean quality grade of cattle that had been sick was the equivalent of U.S. Select while the mean quality grade of carcasses from healthy cattle was equivalent to U.S. Choice.

The least squares means for color values, sarcomere length, 72-h calpastatin activity and Warner-Bratzler shear force values of the treated and non-treated steers are presented in Table 2.

Table 2. Means for tenderness and histochemical traits for steers treated and non-treated for illness during the feeding period

Trait	Treated	Non-treated	$P > F$
*L**	48.2 ± 0.8	48.4 ± 0.4	0.77
*a**	30.8 ± 0.4	30.6 ± 0.2	0.71
*b**	22.7 ± 0.5	22.3 ± 0.2	0.48
Sarcomere length, µm	1.78 ± 0.01	1.79 ± 0.02	0.59
72-h Calpastatin activity	1.07 ± 0.19	1.08 ± 0.09	0.96
Warner Bratzler Shear-14 Day, kg	2.84 ± 0.19	2.82 ± 0.09	0.91

Muscle *L**, *a**, and *b** values were not different between health status groups. Additionally, sarcomere length, 72-h calpastatin activity, and Warner-Bratzler shear force were unaffected by previous illness in these cattle. This may suggest that the differences in growth that affected carcass characteristics did not affect the tenderness of the meat from these animals.

Conclusions

It is evident that there were some differences in quality characteristics between the Treated and Non-treated groups. Cattle identified as sick during the feeding period ultimately produced carcasses that were lighter when compared to those free of illness. Carcasses of healthy cattle were fatter and tended to have larger longissimus muscle areas. Carcasses from healthy steers generally had higher quality grades than those from steers that had been sick. Furthermore, the tenderness attributes did not differ between the treated and non-treated steers. These results further demonstrate that illness during the feeding period can have an effect on carcass characteristics, more specifically with the reduction of carcass weight and overall quality grade in feedlot cattle.

References

Cross, H. R., West, R. L., & Dutson, T. R. (1981). Comparison of methods for measuring sarcomere length in beef semitendinosus muscle. Meat Science, 5, 261–266.

Gardner, B. A., Dolezal, H. G., Bryant, L. K., Owens, F. N., & Smith, R. A. (1999). Health of finishing steers: Effects on performance, carcass traits, and meat tenderness. Journal of Animal Science, 77, 3168–3175.

Koohmaraie, M., Shackelford, S. D., Wheeler, T. L., Lonergan, S. M., & Doumit, M. E. (1995). A muscle hypertrophy condition in lamb (callipyge): Characterization of effects on muscle growth and meat quality traits. Journal of Animal Science, 73, 3596–3607.

McKenna, D. R., King, D. A., & Savell, J. W. (2004). Comparison of clam-shell cookers and electric broilers and their effects on cooking traits and repeatability of Warner-Bratzler shear force values. Meat Science, 66, 225–229.

USDA (1996). Official United States standards for grades of carcass beef. Agricultural Marketing Service, United States Department of Agriculture, Washington, DC.