

Project Summary

The Effect of Anionic Mineral Supplementation on Animal Performance, Plasma and Muscle Calcium, Carcass Composition and Meat Tenderness in Brahman-Influenced Feedlot Cattle

**Principal Investigators: T. Dean Pringle, Ph.D. & Mark Froetschel,
The University of Georgia**

**Study Completed
June 2007**



Funded by The Beef Checkoff

The Effect of Anionic Mineral Supplementation on Animal Performance, Plasma and Muscle Calcium, Carcass Composition and Meat Tenderness in Brahman-Influenced Feedlot Cattle:

Project Summary

Background

Previous meat tenderness research has shown that tenderness is determined in part by the activity of the calpain proteases, which are calcium dependant. A process for improving beef tenderness has been developed around this knowledge which involves injecting a calcium chloride solution into beef carcass subprimals within 30 minutes of harvest. However, the process has not been adopted by the beef packing industry because of the cost of labor and equipment necessary to inject the calcium solution and the prospect of product labeling issues. In contrast, using a feed additive to create metabolic conditions whereby muscle calcium would be increased could provide a minimal cost insurance policy to the packer, ensuring adequate tenderness without requiring labeling. This could also reduce the number of animals failing to meet minimum tenderness standards and allow the beef industry to market a more consistent, uniform and tender product. Thus, the overall objective of this study was to investigate the ability of an anionic mineral supplement to modify the calcium metabolism of feedlot cattle and its potential to enhance beef tenderness.

Methodology

Thirty-three steers of Angus and Brahman inheritance were assigned to one of three treatments: control, low added dietary calcium (DCAD), and low added dietary calcium with a calcium drench immediately prior to harvest (DCAD/Ca). Steers were individually fed in Calan gates for approximately 110 days. During the last 14 days of feeding, the DCAD and DCAD/Ca steers were fed a diet containing 10% Bichlor, a treated soybean meal product that caused the dietary cation/anion difference to decrease from 28 in the control diet to -15 in the DCAD and DCAD/Ca diets. Steers were harvested in two groups. Prior to harvest, the DCAD/Ca steers were restrained in a chute and 3.5 L of a calcium propionate solution containing 150 grams of elemental calcium were pumped into the rumen as an added source of absorbable calcium. Blood and urine calcium and urine pH were measured at harvest and, following a 24-hour chill, quality and yield data were collected along with strip loin and top sirloins. One inch thick steaks were fabricated from strip loins and top sirloins and vacuum-packaged before being randomly assigned to aging times of 1, 3, 7, 14, and 21 days. Following the appropriate aging time, steaks were evaluated for slice shear force determination. Five aged steaks from strip loins were also used to determine degradation pattern of Troponin-T, an assessment of postmortem proteolysis, free and total calcium, and sarcomere length, an assessment of tenderness.

Findings

During the test period (last 14 days of finishing), average daily gain was significantly lower in both DCAD treatments compared to controls. In regards to efficiency, gain:feed ratio during the test period was significantly lower in steers with altered DCAD compared to controls. This was due primarily to steers consuming less feed during the test period and exhibiting weight loss. Blood and urine calcium and urine pH were measured to verify that calcium metabolism in the animal had been modified. In this study, the DCAD and DCAD/Ca groups had lower urine pH than control groups. In addition, urine calcium was higher in the cattle with altered DCAD status compared to controls. These changes suggest the calcium status of the DCAD and DCAD/Ca steers was being changed in such a way as to increase the available calcium to the muscle.

After 21 days of aging, free and total muscle calcium levels were similar across all treatments. In this study there were no differences in sarcomere length after 1 or 21 days of aging time. This is consistent with the minimal changes reported for muscle calcium levels in this trial.

Carcass composition was not affected by altered DCAD or added calcium, although the steers receiving the calcium drench (DCAD/Ca) had lower dressing percentages than the control or DCAD steers. USDA marbling scores were significantly lower in steers with altered DCAD compared to controls. This reduction in marbling could be due to the reduction in feed intake associated with the treatments. The stress of this diet change, along with a reduction in nutrient intake, could have caused mobilization of intramuscular fat and also reduced intramuscular lipid deposition during the final 14 days of finishing.

Steaks improved in tenderness over aging time as expected. Strip loin steaks from the DCAD steers had the lowest slice shear force values and steaks from the DCAD/Ca treatment had the highest values. However, steaks from control steers were not significantly different in tenderness from either of the DCAD treatments. There were no significant differences in slice shear force or thaw loss of top sirloin steaks across dietary treatments.

Implications

Though carcass composition was not affected by calcium treatments, marbling scores were significantly lower in steers with altered calcium as compared to controls. Researchers hypothesized that the stress of this diet change, along with a reduction in nutrient intake, could have caused mobilization of intramuscular fat and also reduced intramuscular lipid deposition during the final 14 days of finishing. Evaluation of blood and urine calcium and pH suggests that the calcium status of the DCAD and DCAD/Ca steers was being changed in such a way as to increase the available calcium to the muscle.

For more information contact:

National Cattlemen's Beef Association
9110 East Nichols Avenue
Centennial, Colorado 80112-3450
(303) 694-0305