



## Effect of Feeding a Low Vitamin A Diet to Beef Steers on Calpain 1 Activation during Meat Aging

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### Objectives

The objective of the study was to determine if a vitamin A deficient diet during beef finishing influences calpain 1 activation during meat aging.

### Materials and Methods

Sixty-four steers of approximately 7 mo of age were subjected to a 14-d acclimation period followed by a 95-d growing period on a low vitamin A diet (1017 IU vitamin A/kg DM) designed to deplete liver vitamin A stores. Steers were assigned to a randomized complete blocked design with a 2 × 2 arrangement of treatments (breed: commercial Angus,  $n = 32$ , and purebred Simmental,  $n = 32$ ; and a Low Vitamin A diet or a control diet). The low Vitamin A (LVA) treatment was a finishing diet with no supplemental vitamin A (723 IU vitamin A/kg DM). The control (CON) treatment was the LVA diet plus supplementation with 2200 IU vitamin A/kg DM for a total of 2923 IU vitamin A/kg DM. Serum retinol concentrations were monitored at the beginning and end of treatment. Upon completion of finishing, steers were slaughtered in two groups at a commercial plant. After fabrication, boneless strip loins (IMPS 180) were collected and transported to NDSU. Samples (approximately 40 g) were collected from the anterior portion of the strip loin on d-2 and d-7 of aging and immediately frozen. Protein was extracted from meat samples in fractionation buffers to yield sarcoplasmic and myofibrillar portions, separated by SDS-PAGE, and transferred to PVDF membranes. Immunoblot analysis was done using anti-desmin (d-2 and d-7) and anti-calpain 1 (d-2) antibodies, and results

were visualized and documented. A pooled control was run on all membranes and set to a value of one for normalizing results. All experimental data were analyzed using the Proc Mixed procedure of SAS with breed of steers, dietary treatments, their interaction and slaughter date used as a fixed effect.

### Results

Calpain 1 autolysis in the sarcoplasmic protein fraction of the d-2 aged loin samples were not affected by treatment or breed. The myofibrillar protein fraction from Angus loins had greater ( $P = 0.02$ ) accumulation of the 76 kDa calpain 1 autolysis product than that from the Simmental loins; the myofibrillar fraction of the loins from the LVA treatment tended ( $P = 0.07$ ) to have more 76 kDa calpain 1 autolysis product than that from the CON. There were not any differences ( $P > 0.19$ ) in the 80 kDa calpain 1 band or the 78 kDa calpain 1 intermediate autolysis product in the myofibrillar fraction. There was a treatment by breed interaction ( $P = 0.01$ ) for desmin in the d-7 aged loins where Angus loins from the CON treatment had less accumulation of the 46 kDa band than Angus loins on the LVA treatment and Simmental loins from either treatment.

### Conclusion

Vitamin A restriction increased protein proteolysis in Angus but not in Simmental steers. The increased calpain 1 autolysis in Angus vs. Simmental, regardless of Vitamin A treatment, indicates a genetic difference that may be the driver for the increased protein degradation in steers a restricted vitamin A diet.