

## Influence Of Zinc And Beta Agonist Supplementation On Beef Carcass Characteristics, Early Postmortem pH, And Longissimus Thoracis Warner-Bratzler Shear Force (#548)

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### Introduction

Growth promoting technologies such as the beta agonist ractopamine hydrochloride (RAC) and nutritional practices such as increased zinc (Zn) supplementation have potential to positively impact beef cattle growth [1, 2]. However, the impact of these strategies (RAC and Zn) on meat quality is not fully understood. The objective of this experiment was to determine the impact of Zn and RAC supplementation in the diet of finishing beef steers on carcass characteristics, early postmortem pH decline, and meat quality development of aged longissimus thoracis (LT) steaks.

1. Genther-Schroeder, O.N., Branine, M.E., Hansen, S.L. (2016). The influence of supplemental Zn-amino acid complex and ractopamine hydrochloride feeding duration on growth performance and carcass characteristics of finishing beef cattle. *Journal of Animal Science* 94: 4338-4345.
2. Ebarb, S.M., Phelps K.J., Drouillard J.S., et al. (2017). Effects of anabolic implants and ractopamine-HCL on muscle fiber morphometrics, collagen solubility, and tenderness of beef longissimus lumborum steaks. *Journal of Animal Science* 95:1219–1231.

### Methods

High percentage Angus steers (~516 kg initial body weight (iBW)) from a single source were fed one of four diets using GrowSafe bunks. Steers were assigned dry rolled corn diets based on growth potential (Gene Max gain score) and iBW: non-Zn supplemented control (CON; diet contained ~30 ppm Zn; n=5), supranutritional Zn supplementation (SUPZN-CON; CON diet+ 60 ppm ZnSO<sub>4</sub>+ 60 ppm Zn amino acid complex); n=5), CON + RAC supplementation (CON-RAC; n=5), and Zn supplementation + RAC supplementation (SUPZN-RAC; n=5). Zn treatments were fed for the entire 89 d trial. RAC supplementation (300 mg/hd/d) occurred for the final 28 d for RAC treatments. At finishing weights (~749 kg), one steer per treatment was harvested at the Iowa State University Meat Laboratory on five separate dates. LT muscle temperature and pH were measured at 1, 3, 6 and 24 h postmortem at the 12<sup>th</sup> and 13<sup>th</sup> rib of the right side of the carcass. Carcass yield data were collected. Rib sections were fabricated into 2.54 cm thick boneless LT steaks. Pairs of adjacent steaks were vacuum packaged, aged for 1, 3, 7, or 14 d, and frozen until quality evaluation. Warner-Bratzler Shear Force (WBS) values were measured on each pair of steaks at each timepoint. Data

were analyzed using the mixed procedure of SAS version 9.4 as a 2x2 factorial contrast with fixed effects of Zn and RAC. Harvest date was included as a block for all quality characteristic analyses. iBW was used as a covariate for live weight, hot carcass weight (HCW), and dressing percentage. HCW was used as a covariate for ribeye area, fat thickness (FT), kidney, pelvic and heart fat percentage, and yield grade. FT was used as a covariate for pH and temperature measurements.

### Results

Longissimus thoracis muscle from SUPZN-CON cattle had a lower pH at 3 and 6 h postmortem than CON-RAC. SUPZN-CON had a lower WBS value at 1 d aging compared with all other treatments. CON had a lower WBS value than SUPZN-CON at 7 d aging. WBS at 3 and 14 d aging was not impacted by treatment. There were no significant differences in carcass characteristics among treatments.

### Conclusion

Zn is an essential trace mineral that is critical for many biological processes including muscle growth and development [3]; understanding its impact on beef tenderness is essential. Other studies have shown that differences in early postmortem pH (3 h) can be associated with tenderness variation in unaged beef [4]. In the current study, a lower pH at 3 and 6 h postmortem was measured in samples with a lower WBS values at 1 d postmortem. The rate of pH decline has been shown to impact tenderness [5]. Identifying the molecular explanations for these differences in pH decline and its impact on tenderness is essential to understanding the impact of Zn and RAC inclusion in the diet. Overall, the current analysis demonstrates that Zn supplementation, without RAC in the diet, resulted in decreased pH at 3 and 6 h postmortem and decreased WBS values at 1 d postmortem.

3. Park, J., Grandjean, C.J., Antonson, D.L., Vanderhoof, J.A. (1986). Effects of isolated zinc-deficiency on the composition of skeletal-muscle, liver and bone during growth in rats. *Journal of Nutrition* 116: 610-617.
4. Marsh, B.B., Ringkob, T.P., et al. (1987). Effects of early-postmortem glycolytic rate on beef tenderness. *Meat Science* 21: 241-248.
5. Melody, J.L., Lonergan, S.M., Rowe, L.J., Huiatt, T.W., Mayes, M.S., Huff-Lonergan, E. (2004). Early postmortem biochemical factors influence tenderness and water-holding capacity of three porcine muscles. *Journal of Animal Science* 82: 1195-1205.

## Notes

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Table 1. Summary of effects of zinc and ractopamine supplementation on beef carcass characteristics and longissimus thoracis quality

Treatment	CON	CON-RAC	SUPZN-CON	SUPZN-RAC	SEM
pH <sub>1h</sub>	6.45	6.60	6.48	6.55	0.06
pH <sub>3h</sub>	6.00 <sup>ab</sup>	6.17 <sup>a</sup>	5.92 <sup>b</sup>	6.02 <sup>ab</sup>	0.10
pH <sub>6h</sub>	5.68 <sup>ab</sup>	5.86 <sup>b</sup>	5.49 <sup>b</sup>	5.70 <sup>ab</sup>	0.11
pH <sub>24h</sub>	5.48	5.46	5.48	5.47	0.04
Temp <sub>1h</sub>	39.26	39.03	39.55	39.24	0.22
Temp <sub>3h</sub>	33.93	33.41	34.81	34.06	0.60
Temp <sub>6h</sub>	23.58	24.02	25.43	23.85	0.61
Temp <sub>24h</sub>	4.00	4.31	4.22	3.65	0.25
WBS <sub>120y</sub>	6.72 <sup>a</sup>	7.64 <sup>a</sup>	5.40 <sup>b</sup>	7.42 <sup>a</sup>	0.37
WBS <sub>300y</sub>	4.66	5.36	4.59	5.18	0.37
WBS <sub>700y</sub>	3.27 <sup>b</sup>	3.95 <sup>ab</sup>	4.22 <sup>a</sup>	4.02 <sup>ab</sup>	0.30
WBS <sub>1400y</sub>	3.39	3.43	3.58	3.75	0.31

<sup>a,b</sup> Means with different superscripts within rows are significantly different ( $P < 0.05$ ).

**Table 1.**  
Effects of Zn and RAC supplementation on beef longissimus thoracis  
pH, temperature, and Warner-Bratzler Shear Force values.

## Notes