

## IMMUNONEUTRALIZATION OF CIRCULATING HORMONES AND GROWTH IN CATTLE

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### Introduction

Immunization against circulating hormones has the potential to enhance growth rates and carcass composition of domestic livestock without the use of exogenous growth hormones. Somatostatin (SS), a potent inhibitor of pituitary growth hormone (GH) secretion, and corticotropin (ACTH), the pituitary hormone released in response to stress, are two key hormones associated with metabolic and growth processes. In this regard, Varner et al. (1980) observed increased pituitary GH secretion in lambs immunized against SS, while Spencer and Garsen (1983) and Chaplin et al. (1984) observed increased growth rates in lambs immunized against SS. On the other hand, adrenal gland corticosteroids are catabolic towards muscle growth (Roeder and Gunn, 1987) and when administered to cattle decreased linear growth and increased carcass fat deposition (Carroll et al., 1963). The objective of this study was to determine the growth promoting effect of immunoneutralization of somatostatin and ACTH.

### Materials and Methods

In the first experiment twenty-four crossbred beef steers weighing approximately 335 kg were allocated into one of two treatment groups. The SS-immunized group (SST) was inoculated in the prescapular lymph node region with 1 mg SS conjugated to 4.8 mg human serum alpha globulin (HSG). The control group (SSC) was inoculated with 4.8 mg HSG alone. In the second experiment another twenty-four crossbred steers weighing approximately 337 kg were also divided into one of two treatment groups. The ACTH-immunized group (AT) was inoculated as described above, but with .2 mg ACTH conjugated to 1.1 mg HSG. The control group (AC) was inoculated with 1.1 mg HSG. Peptides were conjugated using the homobifunctional crosslinker glutaraldehyde. Conjugated using the homobifunctional crosslinker

glutaraldehyde. Conjugates were emulsified with complete Freund's adjuvant (FA) for the primary inoculation (d 0) and incomplete FA for 4 subsequent injections (d 21, 42, 63 and 130) during the approximately 180 d growing-finishing period. The steers were fed a 30% alfalfa hay, 30% alfalfa silage, 37% corn and 3% soybean meal diet during the growing phase and an 83% corn, 12% silage and 5% soybean meal diet during the finishing phase. All cattle were slaughtered at the completion of the finishing phase and carcass characteristics were determined (data not shown).

### Results and Discussion

The effects of immunization against SS on growth performance in growing-finishing steers are shown in table 1. Over the entire growing-finishing period the average daily gain (ADG) in the SS-immunoneutralized steers was 11% greater ( $p < .10$ ) than that for SSC. SS-immunoneutralized steers also consumed approximately 8% more feed per d and had a 10% improvement in feed efficiency over the 184 d period, but the increases in feed intake and feed efficiency were not different ( $p > .10$ ) than the controls. The effects of immunization against ACTH on growth performance of steers are shown in table 2. ACTH-immunoneutralized steers gained 7% more weight per d, consumed 6% more feed and had a 5%

TABLE 1. GROWTH PERFORMANCE OF STEERS IMMUNIZED AGAINST SOMATOSTATIN<sup>a</sup>

Variable	Average daily gain (kg)		S.E.
	Control	SS-immunized	
Day 0-100	1.09	1.14	.03
Day 0-184	1.20	1.33*	.05

<sup>a</sup>Least square means  $\pm$  pooled S.E. in 12 somatostatin immunized and 12 control steers.

\* $p < .10$

TABLE 2. GROWTH PERFORMANCE OF STEERS IMMUNIZED AGAINST ACTH<sup>a</sup>

Variable	Average daily gain (kg)		S.E.
	Control	ACTH-immunized	
Day 0-100	1.11	1.19	.07
Day 0-173	1.24	1.29	.07

<sup>a</sup>Least square means  $\pm$  pooled S.E. in 12 ACTH-immunoneutralized and 12 control steers during d 0-100; and 11 control steers during d 100-173.

improvement in feed efficiency over the growing period (d 0-100), but the increases were not significantly different ( $p > .10$ ) from the controls. The improvement in ADG for the ACTH immunized steers was 4% ( $p > .10$ ) over the 173 d period. Carcass characteristics for SS<sup>1</sup> and AT cattle and their respective controls were similar except that SS-immunized cattle tended to have greater *longissimus dorsi* muscle area (91.5 vs. 86.1 cm<sup>2</sup>;  $p < .08$ ) and greater hot carcass weight (353 vs. 338 kg;  $p < .17$ ). Previous research from this laboratory (Bauer et al., 1988) also indicated that SS-immunoneutralized cattle tended to have greater surges in episodic GH secretion.

These results support, at least in part, a growing body of research which indicates that active immunization against somatostatin may improve the growth performance of ruminants. However, the mechanism of this growth improvement is still not fully understood. Since somatostatin is likely to influence gastrointestinal as well as pituitary gland function, additional research is needed to characterize more fully changes that may occur at these respective sites in SS-immunoneutralized ruminants. Results from the ACTH-immunoneutralization experiment were not conclusive, since significant differences in growth performance,

adrenal gland weight and carcass characteristics were not observed. Analyses of anti-ACTH titers and adrenal gland histology are in progress and may provide additional information on the outcome of this experiment.

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