Endocrine Function of Bulls Exposed to Elevated Ambient Temperature

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Story in Brief

Eight Angus bulls were used to evaluate the effect of elevated ambient temperature on serum testosterone concentration. Bulls were placed in temperature controlled chambers and cannulae were inserted into the jugular veins 15 hr before each of three bleeding periods. Heat stressed and control bulls were exposed continuously to 34 ± 1 C and 22 ± 1 C, respectively. Respiratory rates and rectal temperatures were greater in heat stressed than control bulls. Average serum testosterone concentrations and frequency, magnitude and duration of testosterone secretory spikes were similar for both treatments. Thus, either heat stress does not alter androgen biosynthesis or adjustments in metabolism or disposition of androgens occur during heat stress so blood concentrations do not reflect testicular synthesis.

Introduction

Exposure of farm animals to elevated ambient temperature results in a number of detrimental effects on reproductive performance. In the male, perhaps the most pronounced effect is the reduction in spermatogenesis.

Several studies have been conducted to investigate the effect of elevated temperature on testicular function in bulls. In these studies, the influence of heat stress on accessory sex organs, seminiferous epithelium and various semen characteristics were evaluated. However, the effects of elevated temperature on testicular endocrine function in bulls has not been clearly defined.

This study was designed to assess blood serum testosterone concentration in bulls exposed to elevated ambient temperature. Since serum testosterone concentrations vary greatly in a 24-hr period, a frequent sampling schedule was employed to obtain the best estimate of the effect of heat stress on serum testosterone.

Materials and Methods

Eight Angus bulls averaging about 22 months of age were used in this experiment. Following a three week adjustment period at 22 ± 1 C in temperature control chambers, bulls were randomly allotted to either a control chamber (22 ± 1 C) or a chamber with elevated ambient temperature (34 ± 1 C) and exposed continuously for 15 days. The temperatures used were similar to those employed by Meyerhoeffer *et al.* (1976) which resulted in decreased semen quality.

Cannulae were placed in the jugular veins about 15 hr before each of three sampling periods. Blood samples were taken at 30-minute intervals from 0600 hr to 1800 hr two days before heat stress (−2), and after 6 and 15 days of treatment. Respiratory rates and rectal temperatures were recorded daily throughout the treatment period.

Table 1. Serum testosterone in control and heat stressed bulls[a].

	Day of treatment		
	−2	6	15
Concentration (ng/ml)			
Control	4.2± .4[c]	3.6± .4	4.2± .7
Heat stressed	4.9± .7	4.0± .4	3.6± .3
Increases[b]/12 hr			
Control	2.0± .4	1.8± .2	2.0± .4
Heat stressed	2.0± .4	2.0± .0	1.8± .2
Maximum concentration of increases			
Control	9.2± .6	8.7± .7	9.5± 1.4
Heat stressed	10.3± .5	8.5± .6	9.0± 1.8
Area under plotted testosterone curve (units/12 hr)			
Control	613 ± 66	532 ±61	614 ±100
Heat stressed	766 ±110	588 ±64	536 ± 50

[a]Four bulls per treatment.
[b]Increases in testosterone greater than 1 SD above the $\bar{X}$.
[c]$\bar{X}$ ± SE.

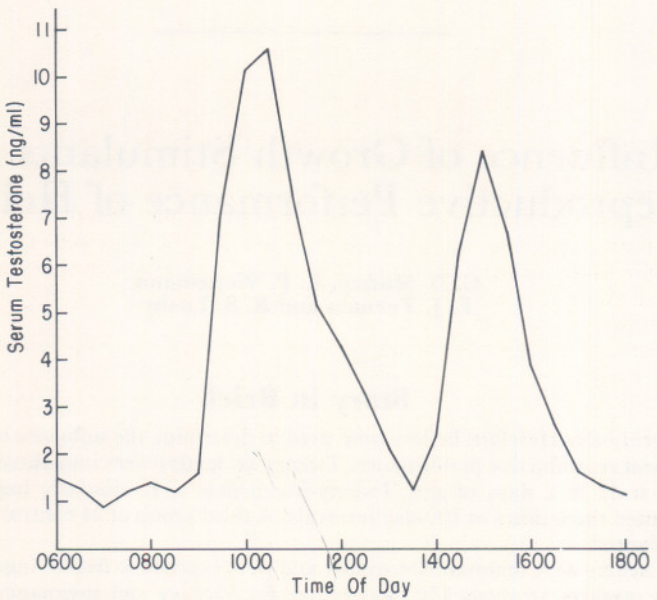

Figure 1. Serum testosterone in control bull 7609 (from 0600 hours to 1800 hours) on day 6 of treatment.

Blood serum testosterone concentrations were quantified by a specific radioimmunoassay that had been previously validated in our laboratory.

Results and Discussion

Average blood serum testosterone was similar for heat stressed and control bulls throughout the treatment period (3.76 ± .26 and 3.86 ± .40 ng/ml, respectively). Endocrine profiles for bulls on both treatments were similar over each 12-hr bleeding period. Figure 1 illustrates the variation in serum testosterone that occurred in a typical bull during a 12-hr sampling period. Both the frequency and magnitude of episodic releases of testosterone were not different between heat stressed and control bulls (Table 1).

Respiratory rates for heat stressed bulls were significantly greater than those for control bulls by day 6 of treatment and averaged 55.2 ± 2.1 and 44.6 ± 1.5 breath/minute, respectively, on day 15. Likewise, rectal temperatures were significantly increased during the experimental period and averaged 38.9 ± .1 C for heat stress compared to 38.6 ± .1 C for control bulls.

The results of this experiment indicate that exposure of bulls to elevated ambient temperature for 15 days does not appear to influence blood serum concentrations of testosterone. The absence of an effect of heat stress on serum testosterone concentrations suggests that either heat stress does not alter testicular androgen biosynthesis or adjustments in extragonadal metabolism or disposition of androgens occur so blood concentrations do not reflect testicular androgen synthesis.

Literature Cited

Meyerhoeffer, D. C., R. P. Wettemann, M. E. Wells and E. J. Turman. 1976. J. Anim. Sci. 43:331.

Influence of Growth Stimulants on Reproductive Performance of Heifers

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Story in Brief

Seventy-five Hereford heifers were used to determine the influence of zeranol on subsequent reproductive performance. Twenty-six heifers were implanted with 36 mg zeranol at 42 ± 2 days of age. Twenty-five heifers were similarly implanted and reimplanted three times at 100-day intervals. A third group of 24 control heifers were not implanted.

All heifers were maintained together and were exposed to fertile Angus bulls with chinball markers at about 450 days of age for 55 days and pregnancy rates were determined by rectal palpation between 70 and 120 days after breeding. Body weights were similar for all treatments at the start of the breeding period.