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Serum Concentrations of Luteinizing Hormone, Testosterone, and Thyroid Hormones in Low and High Serving Capacity Beef Bulls

Garth W. Boyd, Donald D. Lunstra, Bruce D. Schanbacher, and Larry R. Corah¹

Introduction

Adequate sex drive in bulls is essential for natural mating to be successful. Expression of male sexual behavior and mating ability during sexual maturation is dependent upon attaining adequate testicular development and blood levels of luteinizing hormone (LH) and testosterone (T). Several researchers have investigated the relationship between levels of sexual behavior in postpubertal bulls and blood concentrations of LH and T. Some of these researchers reported a positive relationship between T and serving capacity (SC), and others found that individual differences in sexual performance could not be predicted based on circulating levels of T or LH. In those studies, comparisons between sexual behavior of bulls and hormone levels were based on a single blood sample or on infrequent blood sampling. Because no previous studies have utilized a frequent enough sampling regime to determine the episodic release of LH and T, there is a lack of research characterizing the hormonal patterns such as peak frequency, height, and area under the peaks of these hormones in bulls of differing serving capacity. Hormones other than LH and T may influence SC, but little research is available relating these to sexual behavior in bulls. However, thyroid hormones may have some relationship to sexual behavior because earlier research found that removal of the thyroid gland in the bull resulted in disappearance of sex drive and that the feeding of thyroid substance promptly restored sex drive in the hypothyroid bull. Whether this is an effect of a lowered metabolism or a specific endocrine effect has not been established.

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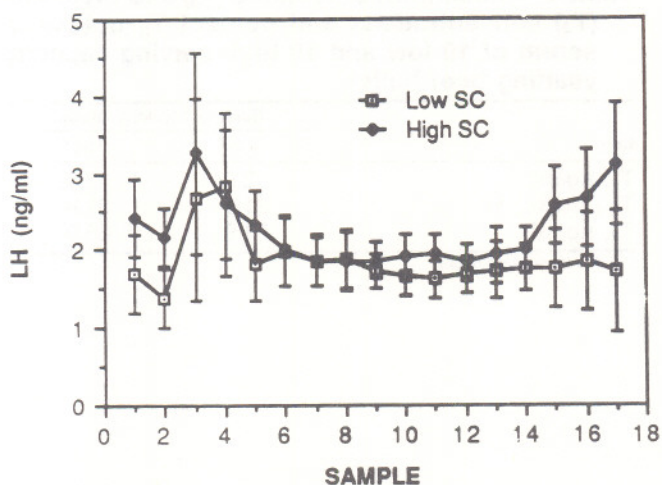


Figure 1—Mean concentrations \pm standard error mean of luteinizing hormone (LH) in serum for 10 low and 10 high serving capacity (SC) crossbred yearling beef bulls sampled every 15 min during a 4-hr period in May 1986.

The objective of the present study was to provide more definitive information on the relationship between the serving capacity of yearling beef bulls and their profiles of LH and T during sexual rest and their blood levels of thyroid hormones. In addition, the interrelationships between these hormones and parameters of testicular function, such as scrotal circumference, paired testicular volume, and seminal traits, were studied.

Procedure

Ten high SC (HSC) and 10 low SC (LSC) bulls (see preceding article in this Progress Report) were moved into individual stalls and acclimated for 4 days to stall housing. Each bull's jugular vein was cannulated; sampling began approximately 2 hr after cannulation; and samples were collected at 15 min intervals for 4 hr. Serum was harvested and frozen until assays were conducted for LH and T. Because of the long half-life of triiodothyronine (T_3) and thyroxine (T_4), serum was pooled for each bull using all samples, and concentrations of T_3 and T_4 and percentage T_3 uptake (a measure of the capacity of thyroxine binding globulin to bind T_3) were determined using assay kits.

Results

Figures 1 and 2 show the average changes in LH and T by 15 min intervals throughout the 4-hr collection period for 10 LSC and 10 HSC bulls. There were no differences between SC groups for avg concentration, number of peaks, avg peak height, or total area under the peaks for either LH or T (Table 1). However, there was considerable variation between individual bull hormone profiles regardless of SC, as depicted by representative bulls in Figure 3. During the 4-hr period, 14 (7 LSC, 7 HSC) bulls showed small fluctuations (peaks of small height) in their hormone profiles, while three bulls (2 LSC, 1 HSC) were

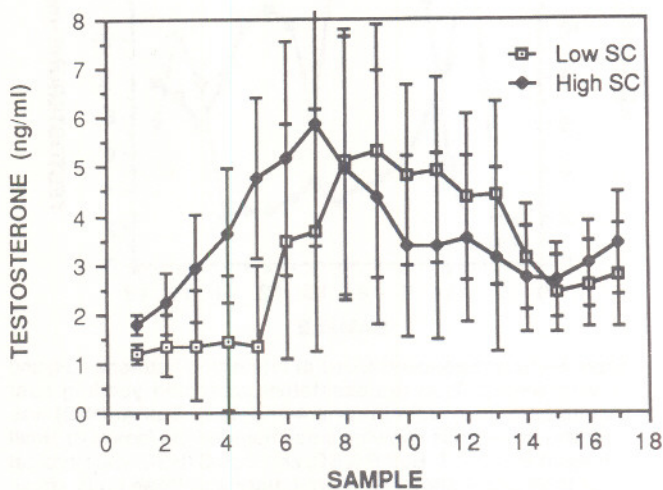


Figure 2—Mean concentration \pm standard error mean of testosterone in serum for 10 low and 10 high serving capacity (SC) crossbred yearling beef bulls sampled every 15 min during a 4-hr period in May 1986.

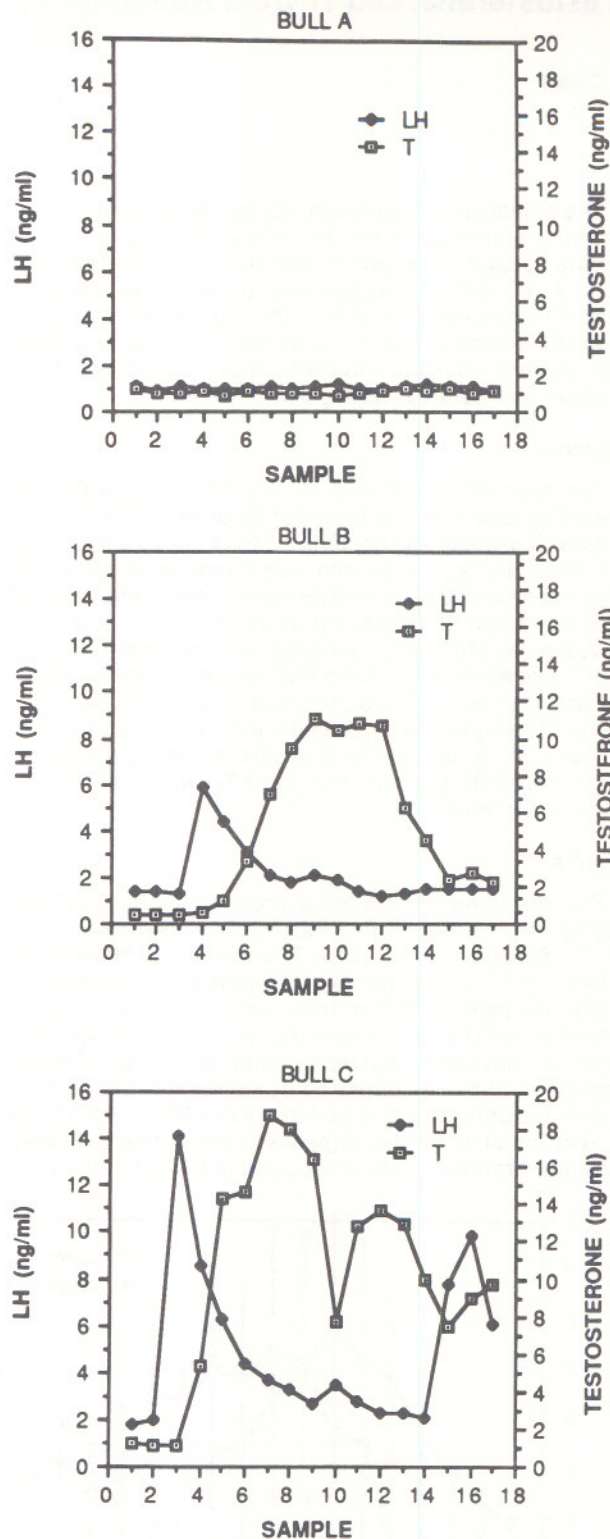


Figure 3—Serum concentrations of luteinizing hormone (LH) and testosterone (T) in representative crossbred yearling beef bulls bled every 15 min for a 4-hr period. Bull A (HSC) was typical for 14 bulls showing small fluctuations (peaks of small height) in LH or T. Bull B (LSC) and Bull C (HSC) were typical for three bulls showing intermediate and three bulls showing extreme height, respectively, for LH and T peaks.

intermediate and three bulls (1 LSC, 2 HSC) showed extreme peak height. Peaks for both LH and T were distributed randomly throughout the 4-hr sampling period. The coincidence of a T peak being preceded by an LH peak for all bulls was 65%, and the lag time was 1 hr.

Correlations between profile characteristics of LH or T and body wt, scrotal circumference, semen quality measures, and sexual behavior were low and nonsignificant for both LSC and HSC bulls. This suggests that circulating levels of LH and T were unrelated to known predictors of bull fertility.

Mean concentrations of T_3 and T_4 and percent T_3 uptake (Table 2) did not differ between SC groups and were similar to levels reported for dairy cows. Most combined correlations between T_3 or T_4 and previously mentioned measures were low and nonsignificant.

In summary, the present study confirms the lack of a relationship between sexual behavior and circulating levels of LH, T, and thyroid hormones, as well as other measures of bull fertility.

Table 1—Mean profile characteristics for luteinizing hormone (LH) and testosterone (T) in serum of 10 low and 10 high serving capacity yearling beef bulls^a

Item	Serving capacity group	
	Low	High
LH:		
Mean, ng/ml	1.8	2.3
No. peaks/4 hr	1.3	1.0
Avg peak height, ng/ml	2.3	3.7
Total area under peaks, ng/ml x min	315.4	379.1
T:		
Mean, ng/ml	3.0	3.5
No. of peaks/4 hr	1.4	1.21
Avg peak height, ng/ml	4.4	6.4
Total area under peaks, ng/ml x min	530.5	595.8

^aLeast-squares means.

Table 2—Mean triiodothyronine (T_3) and thyroxine (T_4) concentrations and percent T_3 uptake in serum of 10 low and 10 high serving capacity yearling beef bulls^a

Item	Serving capacity group	
	Low	High
T_3 , ng/ml	2.01	2.10
T_3 uptake, %	31.6	31.8
T_4 , ng/ml	84.9	86.9

^aLeast-squares means.