



**Interrelationship of Endocrine
and Physiological Events
During the Estrous Cycle
in Brahman Cattle**

Research Center

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THE EFFECT OF VARIOUS DOSE LEVELS OF
ESTRADIOL-17 β UPON SERUM LUTEINIZING
HORMONE IN OVARIECTOMIZED BRAHMAN COWS

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SUMMARY

Estrogen administered at a 20 mg dose causes release of luteinizing hormone from the pituitary gland at different times in Brahman (27.8 hours), Brahman x Hereford (23.8 hours) and Hereford cows (22.2 hours). When estrogen dose levels were varied, the time to luteinizing hormone release varied from 20.3 hours at 1 mg through 26.8 hours at 20 mg. No differences were found between luteinizing hormone responses in magnitude or duration of the response. Dose level affected the numbers of cows responding (0 mg = 0/6, 1 mg = 3/6, 2.5 mg = 5/6, 5 mg = 5/6, 10 mg = 5/6 and 20 mg = 6/6). These data indicate that Brahman cows have a variable response to varying dose levels of estrogen and natural variation in estrogens could cause a variation in estrus and ovulation timing in Brahman cows.

MATERIALS AND METHODS

Twelve mature chronically-ovariectomized Brahman cows were randomly assigned to receive three of six estradiol-17 β treatment regimes at three different bleeding periods. A two week interval between injections was maintained to avoid any refractory response of the animal to the second and third E2 stimulations. Cows were injected with either 0 mg, 1 mg, 2.5 mg, 5 mg, 10 mg, or 20 mg of estradiol-17 β suspended in 2 ml of corn oil. Ten milliliter blood samples were removed from each individual via coccygeal vessel puncture at 0 hr (sample prior to injection) and subsequently at 2, 4, 6, 8, 10, 12, 14, 16, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 44, 46, and 48 hr postestradiol injection. The blood was allowed to clot and was centrifuged for 30 min at 2,500 g at a temperature of 0 C and stored at -20 C until assayed for luteinizing hormone content by radioimmunoassay procedures.

RESULTS AND DISCUSSION

Exogenously administered estradiol-17 β induced a luteinizing hormone surge in 0/6, 3/6, 5/6, 5/6, 5/6, and 6/6 animals given 0 mg, 1 mg, 2.5 mg, 5 mg, 10 mg and 20 mg of estrogen, respectively. The mean luteinizing hormone curves over time by estrogen dosage are shown in Figure 1.

The time to the onset of the luteinizing hormone surge was analyzed by comparison of the response time between estrogen dosages (Table 1). There was an overall trend for increasing dosage to increase the elapsed time to the onset of the surge. Limited data have been reported describing an estrogen dose related luteinizing hormone timing response. The response time at the 20 mg dose level in this trial was quite similar to the timing of the onset of the luteinizing hormone surge after 20 mg estrogen reported in a previous trial. Lower estrogen dosages (i.e., 1 through 10 mg) resulted in shorter intervals from administration to the onset of the LH surge.

TABLE 1. THE ELAPSED TIME FROM ESTRADIOL-17 β (E2) ADMINISTRATION TO THE ONSET OF THE LH SURGE IN OVARIECTOMIZED BRAHMAN COWS.

| Estradiol-17 β dosage (mg) | Time (hr post E2) to the onset of the surge | |
|----------------------------------|--|-----------------|
| | Mean | SE ^a |
| 1 | 10 | 0 |
| 2.5 | 12.4 ^{b,c} | .4 |
| 5 | 16.2 ^{c,d} | 1.3 |
| 10 | 15.2 ^{b,c,d} | 1.2 |
| 20 | 19.5 ^d | 2.3 |

^aStandard error of the mean.

^{b,c,d} Means followed by different superscript letter differ ($P < .05$).

The elapsed time from estrogen administration to the peak luteinizing hormone value was also estrogen dose dependent (Table II). The overall trend was for increasing dosage to increase the time to the peak luteinizing hormone concentration. The time to the peak luteinizing hormone concentration at the 20 mg estrogen dose level was similar to the time reported in ovariectomized Brahman cows given a 20 mg dose of estrogen.

TABLE II. ELAPSED TIME TO PEAK LH CONCENTRATION FOLLOWING VARYING DOSAGES OF ESTRADIOL-17 β IN OVARIECTOMIZED BRAHMAN COWS.

| Estradiol-17 β dosage (mg) | Time (hr) | |
|----------------------------------|---------------------|-----------------|
| | Mean | SE ^a |
| 1 | 20.3 ^b | 2.6 |
| 2.5 | 21.2 ^b | .6 |
| 5 | 24.4 ^{b,c} | 1.0 |
| 10 | 24.8 ^{b,c} | .9 |
| 20 | 26.8 ^c | 1.8 |

^a Standard error of the mean.

^{b,c} Means followed by different superscript letters differ ($P < .05$).

FIGURE 1. MEAN LH CURVES BY ESTRADIOL-17 β DOSAGE OVER TIME

