

Influence of GnRH and Estradiol on Estrus and Luteal Activity of Anestrous Postpartum Beef Cows

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Abstract

The effect of treatment of postpartum anestrous beef cows with gonadotropin releasing hormone (GnRH) or estradiol on onset of first estrus and luteal activity was evaluated. Thirty-four cows were assigned based on body condition at calving and calving date to one of three treatments: GnRH, estradiol cypionate, or control. Ovarian follicles were evaluated by ultrasonography on two consecutive days at 40.5 ($SD = 2.3$ days) days post partum. Blood samples were collected twice a week, starting at 30-d postpartum, then on the day before treatment (d -1), d 0, d 3, d 6, and every 3 or 4 d until d 22 to determine luteal activity. Estrus was monitored with electronic mount detectors (HeatWatch) from d 30 until d 70 postpartum. During 1 to 10 d after treatment, more GnRH cows (67%) had luteal activity than estradiol cows (25%), or control cows (0%). Treatment with GnRH increased ($P < 0.01$) the percentage of cows with luteal activity 11 to 20 d after treatment. Percentage of cows detected in estrus within 6 d after treatment was greater for estradiol (58%) than GnRH (18%) or control cows (0%), and was similar for GnRH and control cows. The number of cows in estrus during 7 to 20 d after treatment was not influenced by treatment. Body condition score at calving did not influence the effect of treatment on estrus and luteal activity. Treatment of postpartum anestrous cows with GnRH initiated luteal activity without estrus, and treatment with estradiol increased the incidence of estrus without altering luteal activity.

Key Words: Postpartum Beef Cows, Estrus, Luteal Activity

Introduction

A major cause of reduced reproductive efficiency in beef cows is an extended anestrous period after calving (Wettemann et al., 1980). Cows must conceive within 85 d after calving to achieve the optimal 12 mo calving interval. Inadequate body condition score (BCS) at calving increases the days to conception (Selk et al., 1988). The number of follicular waves before the first ovulation was increased in thin cows (Murphy et al., 1990; Stagg et al., 1995). First postpartum estrus in beef cows is usually preceded by a transient increase in plasma progesterone and is followed by a normal luteal phase (Perry et al., 1991; Looper et al., 2003). Treatment of anestrous cows with gonadotropin releasing hormone (GnRH) results in short-lived corpora lutea (CL) (Kesler et al., 1980; Wettemann, 1982). The ability of the dominant follicle to produce estradiol is limited during the postpartum anovulatory period (Spicer et al., 1986). Estradiol treatment of cows did not alter the postpartum anestrous interval (Day et al., 1990). An understanding of the endocrine mechanisms that control postpartum anestrous is essential to decrease the interval from calving to conception. The objectives of this study were to determine if treatment with GnRH or estradiol influences the onset of first estrus and luteal activity of postpartum anestrous beef cows.

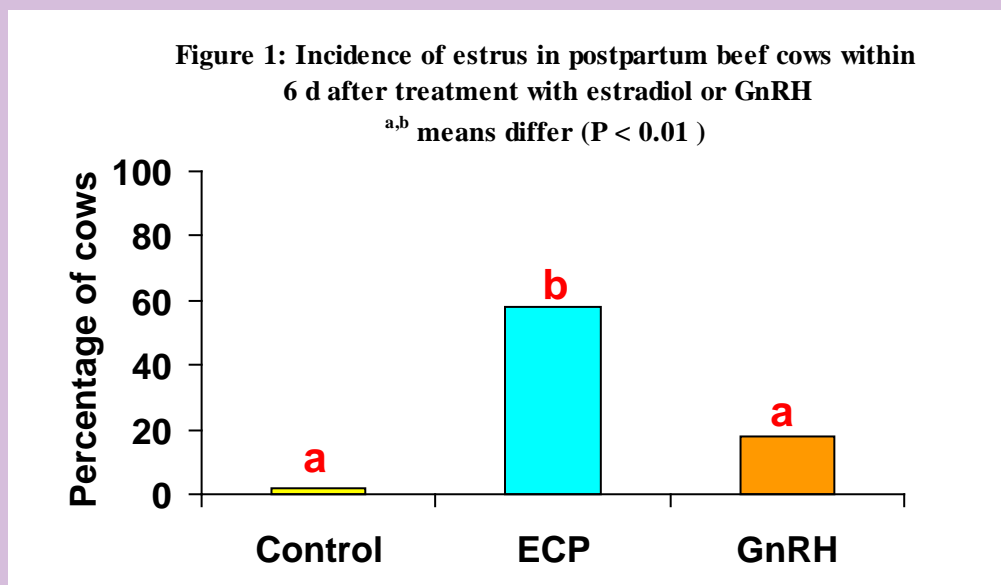
Material and Methods

Body condition score; BCS (1= emaciated, 9= obese) was determined at calving and cows were classified as <5 or ≥ 5 . Thirty-two anestrous cows were randomly assigned based on BCS and calving date, to one of three treatments; gonadotropin-releasing hormone (GnRH, 100 μg ; Cystorelin, Abbott Laboratories; $n=11$), estradiol cypionate (1 mg; Pharmacia & Upjohn, E; $n=12$) or saline (control; $n=9$). Ovaries of each cow were scanned by ultrasonography on two consecutive days at 40.5 d ($SD = 2.3$ days) post partum. Cows with a follicle at least 8 mm on the first day that increased in diameter on the second day were assigned to treatment. Blood samples were collected twice a week, starting at 30 d post partum, then on the day before treatment (d -1), d 0, d 3, d 6 and twice weekly until d 22. Presence of luteal activity was determined when the concentration of progesterone was greater than 0.5 ng/ml. Estrus was monitored with electronic mount detectors (HeatWatch) from d 30 until d 70 postpartum and was defined as cows that received two or more mounts in 4 h. All cows lacked luteal activity and estrus before treatment.

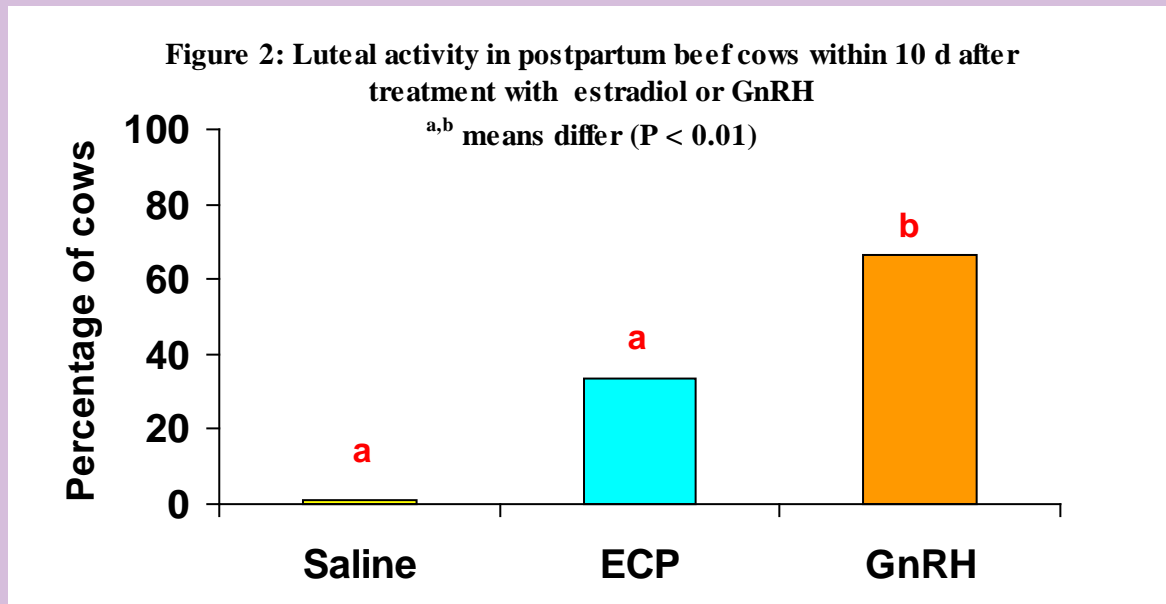
The percentages of cows in estrus within 6 d after treatment, and percentages with luteal activity during d 1 to 10 and d 11 to 20 after treatment were analyzed as a completely randomized block design with a 2 x 3 factorial treatment structure using a generalized linear model (PROC GENMOD; SAS Inst., Inc., Cary, NC). Model included the effect of BCS at calving and treatment as main effects, and the first order interaction. When treatment effects were significant Fisher's exact test was used to compare response variables among treatments.

Results and Discussion

Treatment of postpartum anestrous cows with estradiol increased the percentage of cows in estrus within 6 d after treatment (Figure 1). The percentage of cows in estrus was greater ($P<0.01$) for treatment with estradiol (58%) than for GnRH (18%) or control cows (0%), but was similar for GnRH and control treated cows ($P>0.10$).



The percentage of cows that had luteal activity within 10 d after treatment was greater ($P<0.01$) for GnRH (66.7%) than estradiol (33%), or control (0%) cows (Figure 2).



The incidence of estrus during 7 to 20d and luteal activity during d 11 to 20 after treatment with estradiol or GnRH is summarized in Table 1. The percentage of cows detected in estrus during d 7 to 20 after treatment was not influenced by treatment. In contrast, the percentage of cows with luteal activity 11-20 d after treatment was greater ($P < 0.01$) for GnRH (66.7%) than estradiol (33.3%) and control (20%) cows.

Table 1. Incidence of estrus and luteal activity in postpartum beef cows within d 1-20 after treatment with estradiol or GnRH

Treatment	Cows, no	Estrus during d 7-20 after Trt, %	Luteal activity d 11-20 after Trt, %
Control	9	40.0	20.0 ^a
ECP	12	16.7	33.3 ^a
GnRH	11	25.0	66.6 ^b

^{a,b} means in column with different superscript differ ($P < 0.01$)

Body condition score at calving did not influence the effect of treatment on estrus and luteal activity ($P > 0.10$, Table 2). Treatment of postpartum anestrous cows with GnRH initiated luteal activity without estrus, and treatment with estradiol increased the incidence of estrus without altering luteal activity. This indicates that follicles did not ovulate in response to estradiol and

probably the brain was refractory and an ovulatory surge of LH was not induced. GnRH initiated luteal activity without estrus, indicating that GnRH caused an ovulatory surge of LH.

Table 2. Influence of BCS at calving on estrus (1-6 d), and luteal activity (1-10 d) after treatment of postpartum anestrous beef cows with estradiol or GnRH

Treatment	Estrus		Luteal Activity	
	< 5 ^a	≥ 5	< 5	≥ 5
Control	0	0	0	0
ECP	57	60	28	40
GnRH	17	20	83	60

^a Body Condition Score

Implications

Further studies are needed to determine the factors that regulate GnRH neuron response to estradiol and how do pituitary GnRH receptors change with time in postpartum beef cows. Treatment of postpartum anovulatory beef cows with estradiol or GnRH may influence endocrine and ovarian functions.

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