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Karol Fike
University of Nebraska-Lincoln, karol@ksu.edu

Michael Day
Ohio State University

Keith Inskeep
West Virginia University

James E. Kinder
University of Nebraska-Lincoln, kinder.15@osu.edu

Paul Lewis
West Virginia University

See next page for additional authors

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Authors

Karol Fike, Michael Day, Keith Inskeep, James E. Kinder, Paul Lewis, Robert Short, and Harold Hafs

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Induction of Estrus in Anestrous Suckled Beef Cows

Karol Fike
Michael Day
Keith Inskeep
James Kinder
Paul Lewis
Robert Short
Harold Hafs[1]

Anestrous beef cows can be induced to initiate estrous cycles postpartum by short-term treatment with an intravaginal implant of progesterone.

Summary

Suckled anestrous beef cows (n=362) received either: 1) an intravaginal implant containing progesterone for 7 days plus a 1 mg injection of estradiol benzoate 24 to 30 hours after implant removal; 2) an intravaginal implant containing progesterone for 7 days; 3) a sham implant for 7 days plus a 1 mg injection of estradiol benzoate 24 to 30 hours after implant removal; or 4) a sham implant for 7 days. Treatment with progesterone resulted in resumption of luteal function in suckled anestrous beef cows with most cows developing corpora lutea with a typical lifespan, whereas treatment with estradiol benzoate enhanced the expression of estrus.

Introduction

Treatment with progestins, such as melengestrol acetate, norgestomet or progesterone (P_4) induces estrous cycles in some anestrous cattle. Progestin pretreatment alters uterine function after the first postpartum ovulation and yields normal duration of luteal function. Treatment with estradiol benzoate (EB) following progesterone withdrawal enhances incidence of ovulation in postpartum cows.

The objectives of this experiment were to determine whether: 1) treatment with progesterone via an intravaginal implant induces estrus and formation of corpora lutea (CL) with typical lifespans; and 2) treatment with estradiol benzoate (EB) following progesterone removal improves rates of behavioral estrus and formation of CL with typical lifespans in suckled anestrous beef cows.

Procedure

Suckled anestrous beef cows (n=362) from 25 to 50 days postpartum were used in four locations (Montana, n=97; Nebraska, n=101; Ohio, n=92; and West Virginia, n=72). On average, cows were in their third parity during the experiment. Within each location, cows were stratified by calving date and assigned to receive one of four treatments. Beginning on day 0 (day of treatment initiation) cows were treated with one of the following: 1) an intravaginal implant containing P_4 (EAZI-BREED™ CIDR®, InterAg, Hamilton, New Zealand) for 7 days plus an injection of 1 mg of EB (CIDIROL®, InterAg, Hamilton, New Zealand) 24 to 30 hours after progesterone removal (P_4 + EB); 2) an intravaginal implant containing P_4 for 7 days (P_4); 3) a sham implant for 7

days plus an injection of 1 mg of EB 24 to 30 h after device removal (EB); or 4) a sham implant for 7 days (control). The intravaginal implant contained 1.9 g of P_4 and was designed to release amounts of P_4 typical of the concentration found circulating during the luteal phase of the estrous cycle.

Body condition scores, based on a 1 to 9 scoring system (1 = thin and 9 = fat), were assessed for each animal on the day of implant insertion. Mean body condition scores of cows within each location were: Montana, 4.6; Nebraska, 4.1; Ohio, 4.7; West Virginia, 5.0.

Blood Collection and Response to Treatment

Blood samples were collected on day -7, 0, 8, 15 and 22 (day 0 = implant insertion) via the jugular or tail vein and were used to assess circulating concentration of P_4 as an indicator of luteal function. Based on changes in concentration of P_4 during the experiment, cows were fitted into one of the following response categories: 1) anestrus, 2) typical lifespan CL, 3) short-lived CL, 4) late CL (CL formed late in experiment; not in response to treatment) and 5) early CL (CL formed early in experiment; not in response to treatment).

Behavioral Response to Treatment

To detect onset of behavioral estrus, cows were observed for at least 30 minutes twice daily at approximately 12-hour intervals from day 0 to day 22 of the experiment. Data were placed into one of the following three categories according to behavioral activity: 1) standing estrus, receptive to mounting by other cows; 2) active, cows exhibited sexual activity but would not stand to be mounted; or 3) no estrus, cows did not exhibit any signs of behavioral estrus. Only data from day 0 to day 11 of the experiment regarding behavioral response to treatment were analyzed, with day 9 to day 11 being the period when the majority of behavioral responses to treatment were expected to occur.

Conclusions from this experiment could potentially alter current management scenarios of cow-calf producers. Ultimately, producers are interested in the number of cows exhibiting estrous cycles at the onset of the breeding season and its effect on reproductive efficiency. Therefore, a table of predicted data was compiled and analyzed in which numbers of cows that had formed CL by various criteria, reflecting effects of treatment and natural resumption of estrous cycles, were considered.

Results and Discussion

Response to Treatment

The proportion of cows forming CL with a typical lifespan increased ($P < .001$) in response to treatment with P_4 (Table 1), but location, body condition score, parity and number of days during the postpartum period had no effect. There were no interactions among treatments or location affecting formation of CL with a typical lifespan.

Behavioral Response to Treatment

The proportion of cows exhibiting estrus (i.e. standing estrus or estrous activity) from day 0 to day 11 increased ($P < .05$) in response to P_4 treatment (Figure 1). Similarly, EB increased ($P < .001$) the proportion of cows exhibiting estrus (Figure 1). Body condition score, parity and number of days during the postpartum period did not affect the proportion of cows exhibiting estrus. However, there was an effect ($P < .05$) of location on proportion of cows detected in estrus. There were no interactions between P_4 and EB, location and P_4 or location and EB on the incidence of estrus. The majority of cows exhibiting estrus activity did so from day 9 to day 11 of the experiment; few cows exhibited estrus activity during the treatment period from day 0 to day 8 (Figure. 1).

(Continued on next page)

Table 1. Proportions of cows within each treatment that either formed a corpus luteum or did not initiate luteal function.

	Treatment			
Response[a]	P_4+EB	EB	P_4	Control
Anestrus	15/93 (16%)	29/86 (34%)	28/92 (30%)	31/91 (34%)
Typical lifespan CL	66/93 (71%)	17/86 (20%)	51/92 (55%)	15/91 (16%)
Late CL	0/93 (0%)	14/86 (16%)	0/92 (0%)	6/91 (7%)
Short-lived CL	4/93 (4%)	10/86 (12%)	5/92 (5%)	26/91 (29%)
Early CL	8/93 (9%)	16/86 (19%)	8/92 (9%)	13/91 (14%)

[a] Effect of the following variables on distribution of cows within response categories: P_4, $P < .001$; EB, $P > .10$; P_4 x EB, $P > .10$.

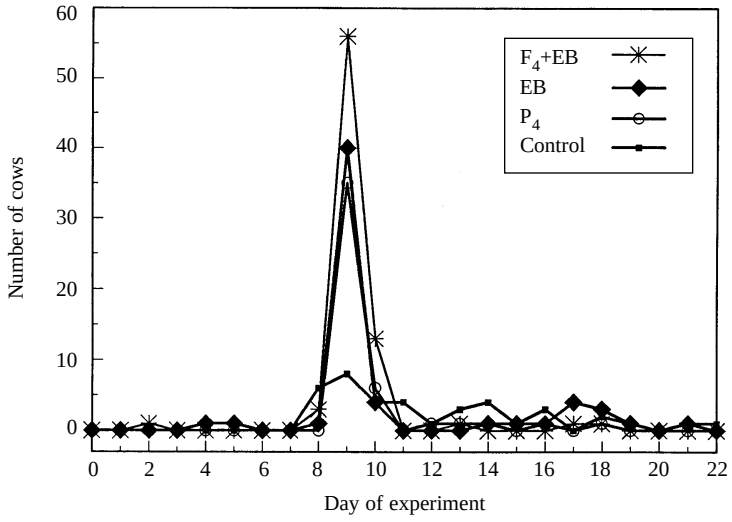

Figure 1. Number of cows within each treatment exhibiting estrous activity or standing estrus during the experiment. Day 0 = initiation of treatments with intravaginal implants.

Predicted Proportions

A greater proportion ($P < .01$) of cows treated with P_4 alone or in combination with EB were induced to form CL with a typical lifespan, compared with untreated cows (Table 2). The effect of P_4 was enhanced ($P < .01$) by EB, but EB alone tended to reduce ($P < .10$) the proportion of cows forming either a short-lived CL or CL with a typical lifespan, compared with untreated cows (Table 2). The combination of P_4 and EB increased the proportion of cows forming CL in response to or during treatment ($P < .01$) and the proportion that had formed CL by the end of the experiment ($P < .05$), compared with untreated cows (Table 2).

Our data reveal short-term treatment of anestrous cows with P_4 can induce earlier ovulation in some cows, increase the percentage of cows exhibiting estrous cycles during the breeding season and, presumably, increase the percentage of cows conceiving at first service. Because these treatments can be used to synchronize estrus in cows exhibiting estrous cycles, they provide the potential to artificially inseminate a large proportion of the herd at the same time.

Providing an exogenous source of estradiol (i.e., EB) increased the proportion of cows exhibiting signs of behavioral estrus. This estrus behavior was concentrated from day 9 to day 11 of the experiment (Figure 1). A greater proportion of cows treated with P_4 and EB were either active or exhibited standing estrus compared with cows treated with P_4 alone. While some cows in the control group may have been induced to exhibit estrous cycles by the concentrated estrous activity of treated cows, more exhibited estrus activity beyond day 11 (Figure 1).

Because estradiol induces the preovulatory LH surge causing ovulation, we expected treatment with EB in addition to P_4 would further increase the proportion of cows forming CL. However data analyzed in Table 1 showed EB did not enhance the response of progesterone in inducing onset of luteal function. From a practical standpoint, however, producers are interested in the number of cows exhibiting estrous cycles at the onset of the breeding season, which should enable more cows to become pregnant early in the season, resulting in fewer nonpregnant cows. Analyzing data as reported in Table 2 allows for the consideration that some cows would have initiated estrous cycles in the absence of progesterone treatment and compares the predicted effectiveness of each treatment with data for control cows in inducing luteal function by the end of the experiment. Based on the predicted data in Table 2, a greater proportion of cows treated with P_4 and EB would be expected to form short-lived or typical lifespan CL compared to untreated cows. Treatment with P_4 alone should increase the numbers of cows developing CL with typical or short lifespans. The data in Table 2 indicate treatment with both P_4 and EB should be more effective in inducing luteal function than other treatments. Combined treatment with P_4 and EB may induce an adequate preovulatory LH surge in a portion of cows with insufficient endogenous estradiol production, increasing the number of cows developing CL.

Treating postpartum beef cows during lactational anestrus with progesterone and estradiol benzoate induced estrus and the formation of corpora lutea with typical lifespans. These responses in anestrous cows can increase the percentage of cows exhibiting estrous cycles at the onset of the breeding season and may result in both more cows being maintained on a yearly calving interval and fewer cows being culled from the herd. Because these treatments can be used to synchronize estrus in cows, they provide the potential for artificial insemination of a large proportion of the herd at the same time.

Table 2. Predicted proportions of cows within each treatment group that formed a corpus luteum by various criteria.

	Treatment			
Response	P_4 +EB	EB	P_4	Control
Formed or would have formed a CL during P_4 treatment[a]	7	8	7	5
Formed a CL with a typical lifespan[b]	59/78 (76%)**	17/70 (24%)	44/77 (57%)*	15/78 (19%)
Formed a short-lived or typical lifespan CL[c]	63/78 (81%)**	27/70 (39%)†	49/77 (64%)	41/78 (53%)
Total cows that formed a CL by 4 d after the end of treatment[d]	78/93 (84%)**	43/86 (50%)	64/92 (70%)	54/91 (59%)
Total cows that formed a CL by end of experiment[e]	78/93 (84%)*	57/86 (66%)	64/92 (70%)	60/91 (70%)[a]

**Proportion differs from control: $P < .01$.
*Proportion differs from control: $P < .05$.
†Proportion differs from control: $P < .10$.
[a]Number of cows predicted to have formed a corpus luteum (CL) during treatment. Values for cows treated with sham devices were calculated from data for response 5 in Table 1. For EB, sham device (16/86) minus P_4 implant (8/93) = 8. For control, sham (13/91) minus P_4 (8/92) = 5. Value for P_4-treated cows was estimated as the mean of these values (6.5, rounded to 7).
[b]Proportion of cows that formed a CL with a typical lifespan. This proportion excludes from the denominator cows that were in metestrus at treatment initiation or that formed or were predicted to form a CL while carrying a device (Early CL).
[c]Proportion of cows that formed either a CL with a typical lifespan or a short-lived CL. Early CL response is excluded from the denominator.
[d]Proportion of cows in which a CL had formed by 4 d after the end of treatment.
[e]Proportion of cows that formed a CL by the end of the experimental period.

[1]Karol Fike, former graduate student; Michael Day, Associate Professor of Animal Science, Ohio State University; Keith Inskeep, Professor of Animal Science, West Virginia University; James Kinder, Professor of Animal Science, University of Nebraska; Paul Lewis, Professor of Animal Science, West Virginia University; Robert Short, Professor of Animal Science, USDA ARS, Livestock and Range Research Laboratory, Miles City, MT; Harold Hafs, Professor of Animal Science, Rutgers University.