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Effects of Melengestrol Acetate (MGA) and Prostaglandin on Blood Serum Progesterone, Luteinizing Hormone, and Reproductive Performance in Beef Cows

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Summary

A study utilizing 64 Angus and Simmental multiparous beef cows was conducted to evaluate the administration of MGA-PGF on the onset of estrus, conception rate, and to determine blood serum hormone profiles (P_4 & LH). Cows utilized were at least 30 days postpartum and stratified by age, breed, and days postpartum into two groups: a treatment group ($n=32$) which received MGA orally for 14 days and a control group ($n=32$) which did not receive MGA. Cows in the study were bled weekly for 9 weeks to monitor serum P_4 levels. Cows with serum $P_4 \geq 1$ ng/mL were considered to have cyclic activity. Cows in both groups were injected with $PGF_{2\alpha}$ 17 days after the last MGA feeding date and bred AI following observed estrus. The number of days from the start of MGA feeding to first detected estrus was lower for treated compared to control cows (19.50 ± 3.70 and 34.31 ± 3.28 , respectively, $P < .01$). The average number of julian days to first estrus was lower for treated compared to control cows (143.81 ± 2.46 and 154.34 ± 3.25 , respectively, $P = .01$). Conception date in julian days was also lower for the treated animals compared to control cows (156.46 ± 2.98 and 166.55 ± 3.21 , respectively, $P = .01$). Treatment animals had a higher level of progesterone from the start of MGA feeding until the end of the bleeding period compared to the control animals ($.41 \pm .04$ and $.19 \pm .04$, respectively, $P < .001$). The average progesterone hormone level in treated cows was higher 48 hours before injecting $PGF_{2\alpha}$ compared to the control animals ($1.59 \pm .12$ vs $0.33 \pm$

$.12$, $P < .001$). Blood serum analyzed for LH concentration was collected 3 days prior to $PGF_{2\alpha}$ injection (Period 1) and 4 days following the $PGF_{2\alpha}$ injection (Period 2). Mean LH levels between treatment and control groups were not different for the 7 days ($1.58 \pm .07$ ng/mL and $1.70 \pm .07$ ng/mL, respectively, $P = .25$). When analyzed by periods, mean LH levels for Period 1 were lower ($1.44 \pm .08$ ng/mL) than mean LH levels for Period 2 ($1.84 \pm .07$ ng/mL, $P < .01$). Results from the present study suggest that MGA decreased days to first detected estrus, resulted in earlier conception, increased conception rate, increased progesterone hormone levels, and increased cyclic activity.

Key Words: MGA, Prostaglandin, LH, Postpartum, Beef Cows

Introduction

In production systems where estrous synchronization is a viable alternative for use in postpartum beef cows, specific treatments or combination of treatments can be used to shorten the effective breeding season and take advantage of the possible stimulatory effect of a progestogen. Melengestrol acetate (MGA) may be used as a management tool to enhance cyclic activity and reproductive performance in postpartum cows. This should result in earlier postpartum conception and increased reproductive performance in beef cattle. Melengestrol acetate is an orally active progesterone that effectively synchronizes estrus in beef heifers and hastens the onset of puberty. Initial studies resulted in a decreased conception

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rate when heifers were bred to the MGA synchronized estrus. Later studies utilizing MGA feeding followed by prostaglandin $F_{2\alpha}$ ($PGF_{2\alpha}$) synchronization of the estrus after the MGA induced estrus resulted in no decrease in reproductive performance. At the present time MGA- $PGF_{2\alpha}$ administration for estrous synchronization works well for the beef heifer. However, very little research data are available for MGA or MGA- $PGF_{2\alpha}$ administration in the suckled beef cow. Since MGA appears to hasten the onset of puberty in the prepuberal beef heifer, it may also have an effect on earlier return to cyclicity in the postpartum beef cow.

The following study was conducted to determine the effect of MGA- $PGF_{2\alpha}$ on conception rate and increasing cyclicity in anestrus beef cows, as well as to evaluate hormone profiles of progesterone and luteinizing hormone in animals following MGA- $PGF_{2\alpha}$ administration.

Materials and Methods

Sixty-four suckled Angus and Simmental multiparous cows from the Cow-Calf Teaching and Research Unit at South Dakota State University were selected to be in the study. The animals were stratified by age, breed, and days postpartum into one treatment ($n=32$) and one control group ($n=32$). All animals in the study had to be 30 days postpartum to the first day of MGA feeding. Only cows in the treatment group were fed MGA for 14 days. Animals were group fed receiving a supplement containing MGA, approximately .4 mg of MGA per head per day. Treatment and control cows were separated for the 14-day feeding period. All animals in the study received a ration of corn silage prior and during the study. All cows in the study were bled weekly for 9 weeks to monitor serum progesterone levels. Cows in both groups were injected with $PGF_{2\alpha}$ (25 mg of Lutalyse, I.M.) 17 days after the last MGA feeding date. Twenty animals in each group were bled 3 days before $PGF_{2\alpha}$ injection (Period 1) and 4 days after the $PGF_{2\alpha}$ injection (Period 2) to monitor serum LH and progesterone levels. All cows were observed for estrus during daylight hours and inseminated 12 hours after observed estrus. Detection of estrus began immediately after the first injection of $PGF_{2\alpha}$. All cows were

inseminated by the same technician using frozen semen. Eleven days after the first $PGF_{2\alpha}$ injection all animals that failed to exhibit estrus within 6 days after the 1st injection were given a second injection of $PGF_{2\alpha}$. After the AI period, all cows were exposed to an Angus bull for a 40-day natural service period.

Blood serum progesterone concentrations were analyzed using a solid-phase radioimmunoassay for all blood samples. Blood serum LH concentrations were analyzed using a monoclonal, double antibody radioimmunoassay and blood for Periods 1 and 2 were analyzed.

Progesterone and LH levels were analyzed using the GLM procedure of completely randomized block design of SAS and least means squares were used for prediction. Categorical data were analyzed using Chi-square analysis. Data were analyzed to determine any hormonal differences between treatments and periods.

Results and Discussion

Reproductive Data

Reproductive data are presented in Table 1. Cows that were treated with MGA resulted in lower number of days from the start of MGA feeding to the first detected estrus compared to the control animals (19.50 ± 3.70 vs 34.31 ± 3.28 days, $P<.01$). Also, the average number of julian days to the first detected estrus was lower in the treatment group compared to the control cows (143.81 ± 2.46 and 154.34 ± 3.25 days, $P<.01$).

Conception date in julian days was significantly lower in the treatment animals (156.46 ± 2.89) compared to the control group animals (166.55 ± 3.21 , $P<.01$; Table 2). Conception rate is presented in Table 3 and was higher in the treatment group compared to the control group. Nineteen animals conceived at the first AI period in the treatment group compared to 9 animals in the control group during the same AI period. Seven animals in the control group conceived within the time frame when the clean-up bull was present compared to 3 animals in the treatment group. Two cows remained open at the end of the 90-day breeding

Table 1. Days to estrus, conception date, days from calving to conception, and average calving date

No. of days	Control group (days)	Treatment group (days)	P-value
Days to 1st estrus from start of MGA feeding	34.31 ± 3.28	19.50 ± 3.7	<.01
Julian days to 1st detected estrus	154.34 ± 3.25	143.81 ± 2.46	<.01
Conception date in julian days	166.55 ± 3.21	156.46 ± 2.89	<.01
Days from calving to conception	104.34 ± 4.59	97.6 ± 4.62	=.30
Average 1995 calving date	84.66 ± 3.45	76.44 ± 3.07	=.08

Table 2. Reproductive data

	Control group (n = 32)	Treatment group (n = 32)
Conception rate		
First AI service	9 (28%)	19 (59%)
Second AI service	13 (40%)	8 (25%)
Clean-up bull	7 (21%)	3 (9%)
Open	3 (9%)	2 (6%)
Cyclic activity ^a	9	21

^aFrom the start of MGA feeding until the first injection of PGF_{2α} determined by P₄ assay.

season in the treatment group vs 3 animals in the control group. This shows that MGA helped to increase conception from the first AI service, as more animals conceived during this particular time period than animals that were not fed the MGA. These results do agree with recent studies done in Kentucky, reporting that MGA improves conception rate in multiparous animals. Days from calving to conception was not different between the two groups for treatment group (97.6 ± 4.62 days) and the control group (104.34 ± 4.59 days; P=.30). The average 1995 calving date was not significantly different between treatment and control groups (76.44 ± 3.07 vs 84.66 ± 3.45 days, respectively, P=.08; Table 1).

The number of days from PGF_{2α} injection to the first AI service was not different between treatment and control groups (3.77 ± .59 and 5.43 ± .84 days, P=11). Progesterone blood serum levels indicate that 21 cows in the treatment group exhibited cyclic activity from the start of MGA feeding until the end of the study compared to 9 animals in the control

group. Treatment with MGA improved estrous response after the first injection of PGF_{2α} in this study. This can be attributed to the improved synchronization of estrous cycles before PGF_{2α} treatment that resulted in more cows with a CL that were more responsive to PGF_{2α} at the time luteal phase was administered. Results of this study demonstrated improvement in fertility as measured by conception rate and cyclicity of cows that received MGA prior to PGF_{2α}. Also, 85% of the cows treated with MGA became pregnant during the first 2 weeks of the breeding period compared to 68% of the control cows (Table 2), illustrating the significant influence of progestogens on improving fertility in the postpartum cow.

Progesterone Data

Treatment animals had a higher level of progesterone from the start of MGA feeding until the end of the bleeding period compared to the control animals (.41 ± .04 ng/mL and .19 ± .04 ng/mL, P<.001). Progesterone levels over the bleeding period are shown in Figure 1.

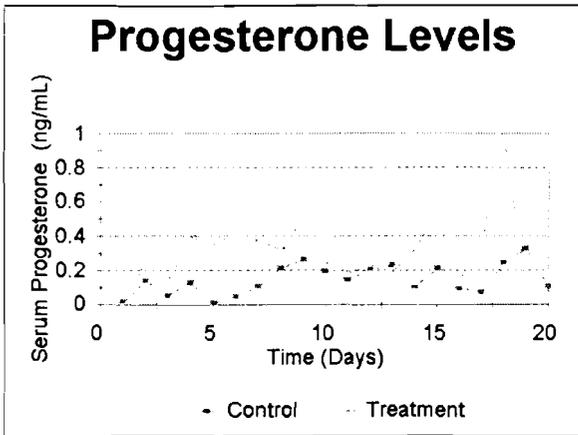


Figure 1. Average progesterone levels during the bleeding period.

Average serum progesterone levels in the treatment group were higher during the bleeding period compared to the control animals. The graph shows that cows treated with MGA had elevated concentrations of progesterone, which indicates a higher number of functional CL and an increase in cyclic activity in the MGA group. Blood serum analyzed for LH and progesterone concentration was collected 3 days prior to PGF_{2α} injection (Period 1) and 4 days following the PGF_{2α} injection (Period 2). The average progesterone hormone level (Figure 2) in treated cows was higher 48 hours before injecting PGF_{2α} compared to the control animals ($1.59 \pm .12$ ng/mL and $.33 \pm .12$ g/mL, $P < .001$). There were significant differences in levels of progesterone in Period 2 in which treated animals had a lower serum progesterone being secreted than the control animals. This shows

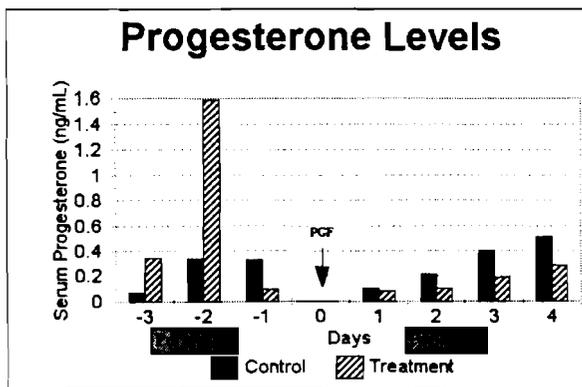


Figure 2. Progesterone levels during the two periods.

that after the PGF_{2α} injection more animals in the treatment group had a functional CL and regression of the CL occurred. Therefore, a lower level of progesterone was secreted from these animals compared to the control animals.

Luteinizing Hormone Data

Luteinizing hormone data is presented in Figure 3. Mean LH levels between treatment and control groups were not different for the 7 days ($1.58 \pm .07$ ng/mL and $1.70 \pm .07$ ng/mL, respectively, $P = .25$). When analyzed by periods, mean LH levels for Period 1 were lower ($1.44 \pm .08$ ng/mL) than for Period 2 ($1.84 \pm .07$ ng/mL, $P < .01$) for all cows. Treated cows in Period 1 had lower LH levels than treated cows in Period 2 ($1.35 \pm .11$ ng/mL vs $1.80 \pm .10$ ng/mL, $P < .01$). The treatment cows were administered MGA which acts like an exogenous progestogen. Cows that have a high level of exogenous progestogen have a negative feedback on LH levels which results in lower levels of LH being secreted.

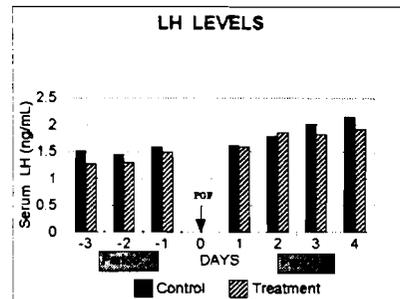


Figure 3. Luteinizing hormone levels during the two periods.

In summary use of MGA-PGF_{2α} in multiparous cows is a practical method of synchronization of estrous cycles in beef cows. This method effectively groups cattle into a stage of the estrous cycle for maximum effect of PGF_{2α} and improves conception rate, decreases days to first detected estrus, increases progesterone levels, and increases cyclic activity.