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Concentrations of progesterone and conception rates in Holstein heifers after hCG administration during the first 3 weeks after estrus (1987)

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CONCENTRATIONS OF PROGESTERONE AND CONCEPTION RATES IN HOLSTEIN HEIFERS AFTER hCG ADMINISTRATION DURING THE FIRST 3 WEEKS AFTER ESTRUS

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Summary

We conducted two experiments to determine the effects of administering human chorionic gonadotropin (hCG) on day 4 or on days 15, 16, and 17 after estrus on conception rates and progesterone secretion by the corpus luteum in Holstein heifers. In the first experiment, 60 heifers received hCG or saline on day 4 after estrus and AI. Conception rates were similar between groups. Concentrations of progesterone were increased in treated pregnant and nonpregnant heifers 7 and 14 days after treatment compared with pregnant and nonpregnant controls.

In the second experiment, 62 heifers received hCG or saline on days 15, 16, and 17 after estrus and AI. Conception rates again were similar between groups. Concentrations of progesterone were higher in treated pregnant heifers on days 16, 17, and 21 after estrus and in treated nonpregnant heifers on days 17 and 21 compared with pregnant and nonpregnant controls. We conclude that stimulation of the newly formed or mature corpus luteum by hCG increased production of progesterone without affecting conception rates.

Introduction

Human chorionic gonadotropin (hCG) is luteotrophic (sustains the function of the corpus luteum) in cows and increases progesterone synthesis by corpora lutea. Since some studies have shown that concentration of progesterone after estrus and AI tend to be higher in cows that remain pregnant than in those that keep cycling, stimulation of the corpus luteum with hCG should have a beneficial effect on conception rates. Early administration of hCG (3 days after estrus and AI) in one study increased progesterone without affecting conception rates. Other experiments involving the administration of hCG 15 days after estrus have reported increased progesterone, prolonged cycle duration and increased pregnancy rate in a low-fertility herd, but decreased pregnancy rate in a high-fertility herd. The objectives of our study were: (1) to determine if production of progesterone from a developing or mature corpus luteum is altered by administering hCG to bred heifers, (2) to determine if increased progesterone in bred heifers influences conception, and (3) to ascertain if production of progesterone from a corpus luteum is affected by the stage of luteal development and(or) the presence of an embryo.

Procedures

Estrous cycles of 122 heifers in two experiments were synchronized using a two injection PGF_2-alpha scheme. In Exp. 1, 60 heifers received 5,000 IU hCG im

(n=31) or 5 ml saline (control; n=29) once on day 4 after estrus (day 0) in November 1984 (n=17), March 1985 (n=17), April 1985 (n=11), or January 1986 (n=15). Blood collected prior to hCG or saline administration on day 4 and 7, 14, and 21 days later was analyzed for progesterone.

In Exp. 2, 62 heifers received 1,000 IU hCG im (n=33) or 1 ml saline (control; n=29) once daily on days 15, 16, and 17 after estrus in February (n=10), April (n=19), July (n=14), or August (n=19), 1986. Blood was collected prior to hCG and 1, 2, and 6 days after the first of three hCG treatments.

Results and Discussion

Exp. 1. Conception rates are summarized in Table 1. Conception of treated heifers (55%) tended (P=.16) to be lower than that of controls (72%). Concentrations of progesterone in treated and control pregnant heifers were similar in blood samples collected before treatment on day 4 after estrus. However, treated pregnant heifers had higher (P<.01) progesterone than pregnant controls 7 days (6.3 $\pm$ .5 vs 2.6 $\pm$ .4 ng/ml) and 14 days (6.2 $\pm$ .5 vs 5.1 $\pm$ .4 ng/ml; P<.10) after treatment. Concentrations of progesterone in serum were similar in both groups 21 days after treatment. Nonpregnant treated and control heifers also had similar concentrations of progesterone prior to treatment on day 4. Progesterone in treated nonpregnant heifers was higher (P<.01) than in nonpregnant controls 7 days (7.0 $\pm$ .5 vs 3.8 $\pm$ .6 ng/ml) and 14 days (6.2 $\pm$ .5 vs 3.7 $\pm$ .6 ng/ml) after treatment. Progesterone concentrations were similar between treated pregnant and nonpregnant heifers on the day of treatment and 7 and 14 days later. By 21 days after treatment with hCG, pregnant heifers had higher (P<.001) progesterone than nonpregnant heifers (5.7 $\pm$ .5 vs 1.6 $\pm$ .5 ng/ml) because of maintenance of pregnancy.

Table 1. Conception rates of heifers treated with hCG or saline 4 days postestrus

Trial	Conception rate (%)		
	hCG	Saline	Trial total
November 1984	5/9 (56)	8/8 (100)	13/17 (77)
March 1985	3/8 (38)	7/9 (78)	10/17 (59)
April 1985	5/6 (83)	4/5 (80)	9/11 (82)
January 1986	4/8 (50)	2/7 (29)	6/15 (40)
Treatment total	17/31 (55)*	21/29 (72)	38/60 (63)

*Tended to be less than saline-treated heifers (P=.16).

Exp. 2. Table 2 summarizes the conception rates in this study. Conception rates were similar between hCG-treated heifers (67%) and controls (59%). Concentrations of progesterone were similar between pregnant treated and control heifers before first day of treatment (day 15 after estrus). On the second and third

days of treatment (days 16 and 17), progesterone was higher ($P<.05$) in treated pregnant heifers than in pregnant controls (4.5 $\pm$ .2 vs 3.7 $\pm$ .3 ng/ml and 5.4 $\pm$ .2 vs 3.8 $\pm$ .3 ng/ml). On day 21 (4 days after the end of treatment), treated pregnant heifers still had higher ($P<.01$) progesterone than pregnant controls (6.1 $\pm$ .2 vs 3.7 $\pm$ .3 ng/ml). Concentrations of progesterone were similar in nonpregnant treated and control heifers prior to initiation of treatment on day 15 and on the second day of treatment (day 16). On days 17 and 21, concentrations of progesterone were higher ($P<.01$) in treated nonpregnant heifers than in nonpregnant controls (5.5 $\pm$ .3 vs 3.4 $\pm$ .3 ng/ml and 3.8 $\pm$ .3 vs 1.3 $\pm$ .3 ng/ml). Treatment with hCG also apparently delayed luteolysis in nonpregnant heifers. Treated pregnant and nonpregnant heifers had similar concentrations of progesterone on each day of treatment, but on day 21 (4 days after the end of treatment) pregnant heifers had higher ($P<.001$) progesterone than nonpregnant heifers (6.1 $\pm$ .2 vs 3.8 $\pm$ .3 ng/ml) because of maintenance of pregnancy.

One-time stimulation of the newly formed (day 4) corpus luteum by hCG (5,000 IU) increased production of progesterone but did not appear to affect conception. Repeated daily stimulation of the mature corpus luteum by hCG (1,000 IU on days 15, 16, and 17) prior to luteolysis increased concentrations of progesterone (and delayed luteolysis) without affecting conception rates of heifers.

Table 1. Conception rates of heifers treated with hCG or saline 15, 16, and 17 days postestrus

Trial	Conception rate (%)		
	hCG	Saline	Trial total
February 1986	4/6 (67)	1/4 (25)	5/10 (50)
April 1986	8/10 (80)	6/9 (67)	14/19 (74)
July 1986	3/7 (43)	5/7 (71)	8/14 (57)
August 1986	7/10 (70)	5/9 (56)	12/19 (63)
Treatment total	**22/33 (67)**	**17/29 (50)**	**39/62 (63)**