PREGNANCY RATES OF DAIRY COWS AT FIRST SERVICE: INFLUENCE OF GONADOTROPIN-RELEASING HORMONE AND TIMING OF AI RELATIVE TO ESTRUS

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Summary

We demonstrated that gonadotropin-releasing hormone (GnRH or Cystorelin®) failed to improve pregnancy rates at the first service. When GnRH injection and insemination are both carried out either in early or late estrus or if cows are bred in early estrus and given a GnRH injection later in estrus, pregnancy rates are reduced by 9 to 13 percentage points compared to breeding according to the am-pm rule without GnRH treatment (control). Pregnancy rates of cows injected with GnRH early in estrus and bred in late estrus were similar to controls injected with saline and inseminated late in estrus (46 vs 43%). Altering the time of breeding and the time of GnRH injection to either early or late estrus did not improve pregnancy rates. We continue to recommend using GnRH only for repeat breeders, because GnRH consistently improves pregnancy rates at 3rd or 4th service, but not at first services.

Introduction

Pregnancy rates are increased in repeat breeders when GnRH is given at the time of 3rd or 4th service (1988 Dairy Day, KAES Rep. Prog. 554, pp 16-18). In contrast, we further reported that injecting GnRH at the time of insemination failed to increase pregnancy rates of dairy cows bred at first services after calving (1984 Dairy Day, KAES Rep. Prog. 460, pp 26-27), and this has been confirmed in several other U.S. studies since 1984. However, research in Europe, Japan, and other foreign nations have reported increased pregnancy rates at first services after GnRH treatments. Why is there an inconsistency among these studies? It could be that U.S. cows, which are fed more concentrates than other dairy cows throughout the world, are inherently different. Although this may be true and may influence when cows begin their estrous cycles after calving, there appeared to be more obvious reasons for the differing fertility effects of GnRH on pregnancy rates.

In all previous studies except one, GnRH injections were given at the time of AI. The timing of GnRH treatment and the timing of insemination relative to the beginning of heat may be very important determinants of the pregnancy-rate response. We know that the am-pm rule of breeding produces the best fertility results, and breeding too early reduces fertility. The objective of our study was to determine the effect of GnRH injection on pregnancy rates, when it is given in either early or late estrus and the timing of inseminations are altered from the am-pm rule.

Procedures

Dairy cows were given 25 mg Lutalyse® on Monday mornings to induce estrus for first services after they were at least 45 days fresh (October, 1987 to May, 1989). Cows were observed for

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heat (beginning at 0730 on Tuesday until Friday night at 2100) four times daily (0730, 1100, 1730, and 2100) and, when detected in estrus, were assigned randomly to each of six treatment groups (Table 1). Blood was collected at the time of hormone injection (0 hr) and again 2 hr later to monitor changes in luteinizing hormone (LH), a pituitary hormone whose secretion is stimulated by injections of GnRH.

Table 1. Treatments of Dairy Cows at First Services after Calving

Treatment group	Hormone injected	Time relative to first detected heat	
		Injection	Insemination
1	GnRH	Early[a]	Early
2	GnRH	Early	Late[b]
3	GnRH	Late	Early
4	GnRH	Late	Late
5	Saline	Early	Early
6	Saline	Late	Late

[a]Injection and/or insemination was conducted within 1 hr after first detected heat.
[b]Injection and/or insemination was given 12 to 16 after first detected heat.

Results and Discussion

Normally at the onset of estrus, when cows first stand firm for a mounting herdmate, a large discharge of LH is released from the pituitary gland, which increases blood concentrations of LH for about 8 to 12 hr. This release of LH, known as the preovulatory surge of LH, induces maturation and ovulation of the egg from a follicle on the ovaries. We would expect concentrations of LH in blood serum to be higher in cows that were injected earlier than later in estrus. Table 2 summarizes the changes in serum LH at 0 hr and 2 hr after injections of GnRH or saline for each of the six treatment groups.

Concentrations of LH in blood serum were higher ($P<.01$) at 0 hr in all cows that were injected early in estrus than those injected later in estrus, regardless of treatment (blood samples preceded hormone injections). Two hr after injections, LH concentrations were increased ($P<.05$) by 43% for GnRH, early-injected cows and by 153% in all GnRH, late-injected cows. As a result of increased LH in serum 2 hr later, all GnRH, early-injected cows had higher ($P<.01$) LH (by 94%) than saline, early-injected cows, and GnRH, late-injected cows had higher ($P<.01$) LH (by 109%) than saline, late-injected cows.

Table 2. Concentrations of LH (ng/ml) in Blood Serum at 0 hr and 2 hr after Injections of GnRH or Saline

Hormone injected	Time of injection[a]	Hours after GnRH or saline 0	Hours after GnRH or saline 2
GnRH	Early	5.6 ± .7[b]	7.9 ± .8[cd]
GnRH	Early	5.8 ± .8[b]	8.4 ± 1.1[cd]
Saline	Early	4.5 ± .7[b]	4.2 ± .8
GnRH	Late	1.1 ± .7	2.5 ± .8[ce]
GnRH	Late	0.7 ± .8	2.1 ± 1.1[ce]
Saline	Late	1.1 ± .8	1.1 ± 1.0

[a]Injections were given early (1 hr) or late (12 to 16 hr) in estrus, based on 4× daily heat detection in which first detected estrus is 0 hr.
[b]Different (P<.01) from all late-injected groups at 0 hr.
[c]Different (P<.05) from 0-hr concentrations within treatment for all GnRH-treated cows (early and late injections).
[d]Different (P<.05) from 2-hr concentrations of saline-treated cows injected in early estrus.
[e]Different (P<.05) from 2-hr concentrations of saline-treated cows injected in late estrus.

Pregnancy rates are summarized in Table 3. Pregnancy rates for all cows inseminated early in estrus tended to be lower (33%) than those for cows inseminated later in estrus (44%), except for the GnRH group that was injected and inseminated late in estrus (30%). Only those cows injected with GnRH early in estrus and then inseminated late in estrus had pregnancy rates (46 vs 43%) similar to those of the control group (injected with saline and inseminated late in estrus).

Based on our results, we do not recommend the use of GnRH as a profertility aid for cows inseminated at first breedings after calving. These results agree with our earlier report (cited above) in which GnRH injections were all given at the time of insemination. Even though cows were inseminated early after calving, control cows had pregnancy rates of 43%. Use of GnRH lowered pregnancy rates except for one group, which was similar to controls. In contrast, utilizing GnRH at the time of insemination of repeat breeders (3rd and 4th services) will improve pregnancy rates.

Table 3. Pregnancy Rates of Dairy Cows at First Service

Hormone injected	Time of injection[a]	Time of AI[a]	No. preg/ no. AI	Pregnancy rate, %
GnRH	Early	Early	18/52	34.6[b]
GnRH	Late	Early	18/53	34.0[b]
Saline	Early	Early	15/50	30.0[b]
GnRH	Late	Late	16/53	30.2[b]
GnRH	Early	Late	23/50	46.0
Saline	Late	Late	29/67	43.3

[a]Relative to first detected heat (0 hr). See footnotes in Table 1.
[b]Lower (P<.05) pregnancy rate (32 vs 44%) than cows in the remaining experimental groups.