Effect of Preinsemination Injection of Gonadotropin-Releasing Hormone on Reproductive Performance of Dairy Cattle[a, b]

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Abstract

To determine effects on reproductive performance, Holstein dairy cows and heifers on two Purdue farms were injected with 100 μg gonadotropin—releasing hormone (GnRH) or saline as soon as possible after detection of estrus. Time from detection of estrus to injection was 2.2 h, injection to breeding was 6.4 h, and detection of estrus to breeding was 8.6 h. Conception rate of animals injected with GnRH was 51.8% of 282 which was not different from the conception rate of 51.5% of 264 breeding when animals were injected with saline. Conception rates were not different for GnRH or saline animals at first, second, or third or more services. Conception rates at next service also were not affected by GnRH. Interval to next service (33 d for GnRH cows, 38 d for saline cows) and days postcalving to conception (122 for GnRH cows, 127d for saline cows) were not significantly affected by treatment. In conclusion, administration of GnRH soon after detection of estrus did not affect reproductive performance of dairy cattle.

Key words: GnRH, reproduction, dairy cattle, fertility

Introduction

Hormonal aberrations are known to cause infertility in dairy cattle. Administration of gonadotropin-releasing hormone (GnRH) or related gonadotropins has resulted in varying changes in conception rates. The weighted average of studies (1-7) involving 3,375 cows indicated that conception rates were increased 7.5% when GnRH was injected at or close to time of insemination. Changes in conception rates ranged from minus 2% (7) to plus 13% (1). Most of these studies involved GnRH administration at time of breeding for first service only. However, Moller and Fielden (4) reported an increase in conception rate of 9.3% when GnRH was injected 0-6 h before breeding. Additionally, Stephenson *et al.* (8) and Lee *et al.* (3) have shown increased conception rates in problem breeder cows of 21 and 25%, respectively, when GnRH was administered at breeding.

Possible effects of GnRH may be through enhanced synchronization of ovulation and breeding via luteinizing hormone (LH). Since GnRH and the following LH peaks occur near the onset of estrus (9), injections of GnRH before breeding may more closely synchronize ovulation with the presence of sperm cells than GnRH at breeding. If an asynchrony of LH and estrus caused delayed ovulation in potential problem breeding (10), subsequent fertilization of the egg by the sperm would then be increased by exogenous GnRH at the onset of estrous. Another possible effect of GnRH via LH is to stimulate progesterone secretion which could increase conception rate at the initial breeding or at the next breeding (10, 11). Secretion of additional LH may improve development of the corpus luteum and increase progesterone secretion in the next cycle or subsequent pregnancy. Higher progesterone concentrations tend to increase fertility (12, 13).

Thus, the purpose of this study was to determine the

(a)Publication number 10,205 of the Purdue Agriculture Experiment Station.

(b)Gonadotropin—releasing hormone (Cystorelin®) was generously donated by CEVA Laboratories, Inc., Overland Park, Kansas 66212.

(c)Deceased.

effects on fertility of dairy cattle when GnRH was administered soon after detection of estrus and then followed by later breeding. This research also was to determine the effects of GnRH on days to next service for nonpregnant animals and on days postcalving to conception.

Materials and Methods

Animals. Holstein dairy cows and heifers from two locations, the Purdue University herd West Lafayette, IN, and the Southern Indiana Purdue Agriculture Center herd, Jasper, IN, were utilized.

Treatments. Odd-numberd animals received 2 ml IM of saline (.9% NaCl) as soon as possible after estrus detection. Even-numbered animals received 2 ml IM of GnRH (100 μg) as soon as possible after estrus detection. Treatments were administered on consecutive breedings until the animal was pregnant. Times were recorded for estrus detection, injection of treatment, and breeding. All animals were bred by artificial insemination. Conception rates were determined by actual calving results or status of animals at time of disposition from herd.

Statistical Analysis. Conception rates were analyzed by Chi square analysis (14). Times from detection of estrus to treatment, treatment to breeding, and detection of estrus to breeding were analyzed by analysis of variance (14) with treatment and pregnancy state as independent variables. Days to next service and days postcalving to conception were analyzed by analysis of variance (14), including treatment, farm, service number, parity, and all interactions as independent variables.

Results

Time intervals. Time intervals from detection of estrus to injection of treatment, injection of treatment to breeding, and detection of estrus to breeding did not differ. (P>.10) for pregnant and non-pregnant cows injected with either saline or GnRH (Table 1).

TABLE 1. Relative time (hrs) of estrus detection, saline or GnRH, and breeding treatment.

	Saline		GnRH	
Time interval[a]	Pregnant	Nonpregnant	Pregnant	Nonpregnant
Treatment Detection	2.4 ± 3.5[a]	2.4 ± 3.6	1.5 ± 2.5	2.4 ± 3.5
Breeding-Treatment	6.2 ± 5.1	6.4 ± 5.7	6.8 ± 4.7	6.1 ± 5.1
Breeding-Detection	8.5 ± 4.8	8.8 ± 5.6	8.4 ± 4.7	8.5 ± 5.0

(a) x ± SD

Effects of time from treatment to breeding on conception rates are in Table 2. All comparisons of cows injected with either saline or GnRH were not significantly different (P>.10). However, cows with more than 6 h between injection of GnRH and breeding tended (P<.10) to have higher conception rates than cows with less than 6 h between GnRH and breeding.

TABLE 2. Effect of time from treatment to breeding on conception rates in dairy cattle.

	Initial Service		Next Service	
Time from treatment to breeding	Saline	GnRH	Saline	GnRH
Overall	51.5 (264)[a]	51.8 (282)	47.4 (114)	46.4 (125)
Less than 6 hr	51.5 (135)	44.4 (133)	44.1 (59)	47.1 (70)
6-12 hr	51.6 (93)	59.2 (120)	48.8 (41)	40.9 (44)
Greater than 12 hr	52.8 (36)	55.2 (29)	57.1 (14)	63.6 (11)

(a) % pregnant (no. bred)

Effect of GnRH by Service Number. Overall conception rate was not affected (P>.10) by GnRH or saline-injection at either initial service or next service (Table 3). There also were no differences (P>.10) between conception rates for GnRH or saline injected cows at first, second, or later services. There was an 8.6% nonsignificant increase in conception rate for GnRH animals bred more than 2 times.

TABLE 3. Effects on conception rates of GnRH or saline by service number.

	Initial Service		Next Service	
Service number	Saline	GnRH	Saline	GnRH
Overall	51.5 (264)[a]	51.8 (282)	47.4 (114)	46.4 (125)
1st Initial	52.0 (152)	50.9 (161)	44.8 (67)	47.2 (72)
2nd Initial	53.6 (69)	51.4 (72)	43.3 (30)	38.2 (34)
3rd Initial	46.5 (43)	55.1 (49)	64.7 (17)	57.9 (19)

(a) % pregnant (no. bred)

Effect of GnRH by Parity and Herd. There were no differences (P>.10) in conception rates by parity (Table 4) or herd (Table 5) for GnRH or saline treated animals at either initial service or next service.

TABLE 4. Effects on conception rates of GnRH or saline by parity numbers.

	Initial Service		Next Service	
Parity	Saline	GnRH	Saline	GnRH
Overall	51.5 (264)[a]	51.8 (282)	47.4 (114)	46.4 (125)
0 (Heifers)	63.9 (61)	58.6 (70)	57.1 (21)	48.1 (27)
1	62.1 (58)	56.9 (72)	61.1 (18)	48.3 (29)
2	35.4 (65)	48.2 (56)	34.2 (38)	39.3 (28)
3	47.5 (80)	44.0 (84)	48.6 (37)	48.8 (41)

(a) % pregnant (no. bred)

TABLE 5. Effects on conception rates of GnRH or saline by herd.

	Initial Service		Next Service	
Farm	Saline	GnRH	Saline	GnRH
Overall	51.5 (264)[a]	51.8 (282)	47.4 (114)	46.4 (125)
1	51.1 (190)	51.7 (209)	47.6 (84)	43.8 (96)
2	52.7 (74)	52.0 (73)	46.7 (30)	55.2 (29)

(a) % pregnant (no. bred)

There was no effect (P>.10) on days to next detected estrus in nonpregnant cows due to treatment, treatment interactions, service number, parity, or herd (Table 6). Effects were significant for parity x service number (P<.05) and herd x parity x service number (P<.01). Other interactions had no effect (P>.10) on days to next estrus.

TABLE 6. Effects of GnRH or saline on days to next estrus and days postpartum to conception.

Treatment	Days to next detected estrus in nonpregnant cows	Days postpartum to conception
Saline	37.8 ± 24.5[a]	127.2 ± 60.1
GnRH	33.3 ± 20.2	122.1 ± 62.0

(a) $\bar{X}$ ± SD

Treatment and treatment interactions had no effect (P>.10) on days postcalving to conception (Table 6). Service number (P<.01), herd (P<.01), parity (P<.05), herd x service number (P<.01) and herd x parity (P<.01) affected days to conception. Other interactions were not significant (P>.10).

Discussion

In this study, conception rate of animals injected with GnRH soon after detection of estrus and bred at later times was not different from the conception rate of control animals. Although no other data are available where cows have been injected routinely with GnRH near first detection of estrus, studies show that injection of GnRH at the time of breeding have yielded varying results but have tended to have positive influence on conception rates (1-3, 5-7). Conception rates increased 9.3% when cows were injected with GnRH 0-6 h before first breeding (4). Administration of GnRH and breeding soon after estrus detection consistently resulted in higher conception rates than when GnRH treatment and breeding occurred 12 h after estrus detection (8).

Since the GnRH peak normally occurs near the onset of estrus (9), injection of GnRH before breeding would be more likely to correct an asynchrony of breeding and ovulation than GnRH at breeding. However, our data indicated no effect on conception rates of GnRH except possibly when the time interval from injection of GnRH to breeding exceeded 6 h. The lack of a positive response to exogenous GnRH in these two herds may have been related to acceptable conception rates (52%) in the control cows.

Although GnRH at breeding enhances progesterone secretion in pregnant cows (11), days to next service and days postpartum to conception were not significantly improved by GnRH treatment in our study. Administration of GnRH at 14 days postpartum and at first breeding also did not affect these parameters (3).

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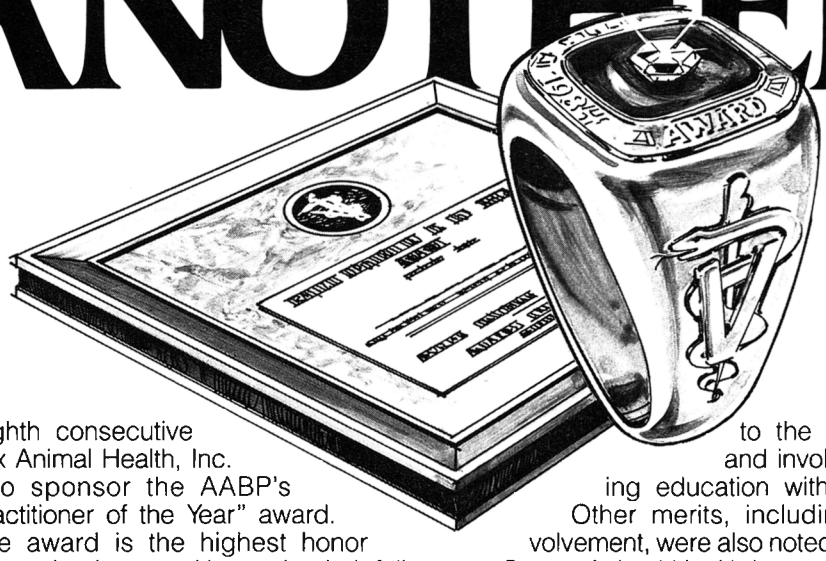

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