Effect of Bovine Somatotropin Treatment on AI Pregnancy Rate in Dairy Heifers

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Story in Brief

This study investigated the effects of bovine somatotropin (bST; Posilac) treatment at or after insemination on subsequent pregnancy rate in diary heifers. Crossbred dairy heifers (n = 73), between 14 to 15 months of age and weighing 728 ± 7.9 lb, were used for the study. Estrus was induced by a single or repeated (at 14-day intervals) injections of 25 mg of prostaglandin F2alpha. Heifers were observed at least twice daily and artificially inseminated about 12 h after detection of estrus. At estrus, heifers were randomly assigned across treatments. Treatments were bST injection (500 mg, s.c.) at either the time of insemination (Day 0), on Day 14, or at both insemination and on Day 14. Untreated animals served as controls. On Day 45 after estrus, ultrasonography was used to determine pregnancy status and measure fetal-crown rump length. Treatment of heifers with bST at insemination had no effect (P = 0.31) on pregnancy rate when compared with the control group. However, bST treatment on Day 14, or on both Day 0 and 14, reduced (P = 0.01) pregnancy rate, when compared with the control and Day 0 bST treatment groups. Pregnancy rate was similar (P = 0.73) for heifers receiving bST on Day 14 versus Day 0 and 14. Fetal growth, as measured by crown-rump length, was unaffected by treatment (P = 0.60). Results indicate the timing of bST treatment after the onset of estrus can influence the subsequent pregnancy rate in dairy heifers.

Introduction

Treatment of superovulated, lactating dairy cows with bovine somatotropin (bST; Posilac, Monsanto Corp., Trenton, N.J.) at the first insemination (onset of estrus) has been reported to decrease the number of unfertilized oocytes, while increasing the development rate and morphological quality of embryos (Thatcher et al., 2001). In contrast, another report (Hasler et al., 2003) indicated that bST treatment initiated 9 to 12 days before superovulatory treatment and continuing every 14 days in repeatedly superovulated beef cows had no effect on the quantity or quality of embryos recovered.

Treatment of lactating dairy cows with bST 10 days before insemination (Moreira et al., 2000a,b) or at insemination (Moreira et al., 2000b), in a timed-insemination protocol, has also been reported to increase pregnancy rates. However, both of these studies reported that bST had no effect on pregnancy in cows subjected to a second timed insemination, after failing to conceive at the first timed insemination. Others have reported that treating non lactating dairy cows with bST at breeding and again on Day 11 doubled the length of Day 17 elongating embryos, but reduced overall pregnancy rates (Kamimura et al., 2002).

The contrasting results of the studies cited suggest that the timing of bST treatment in relation to estrus and/or repeated treatment with bST may influence the effect bST has on pregnancy rates. Therefore, the present study was conducted to investigate the effect of bST (Posilac) treatment given at and/or after artificial insemination on subsequent pregnancy rate in dairy heifers. Also investigated was the effect of bST on fetal size at 45 days of gestation.

Experimental Procedures

Crossbred Holstein, Jersey, and Brown Swiss dairy heifers (n = 73), between 14 to 15 months of age and weighing 728 ± 7.9 lb, were used for the study. Estrus was induced by a single or repeated (at 14-day intervals) injections (im) of 25 mg of PGF2alpha (Lutalyse, Pharmacia and Upjohn, Kalamazoo, Mich.). Heifers were observed two or more times daily for estrus and artificially inseminated about 12 h after detection of estrus. A single lot of frozen-thawed semen from a Jersey sire was used for all inseminations. All inseminations were by a single, experienced technician.

At estrus, heifers were randomly assigned across treatments in a 2x2 factorial arrangement. Treatments were bST injection (Posilac, 500 mg, s.c.) at either the time of insemination (Day 0), on Day 14, or at both insemination and on Day 14. Untreated animals served as controls. On Day 45 after estrus, ultrasonography was used to determine pregnancy status and measure fetal-crown rump length. Chi-Square analysis was used to evaluate the effect of treatment on pregnancy rate. Analysis of variance was used to compare fetal crown-rump length among treatments.

Results and Discussion

In contrast to studies with lactating dairy cows, bST treatment at insemination had no effect (P = 0.31) on pregnancy rate when compared with the control group (Table 1). This could be due to inherent differences in the fertility of lactating dairy cows versus heifers. Since the early 1950's, fertility of lactating dairy cows has declined over 50%. During the same time period, fertility has remained constant for non lactating dairy heifers. Somatotropin stimulates the liver to synthesize and release insulin-like growth factor 1 (IGF 1). Insulin-like growth factor in turn, has several roles in reproduction, including selection and growth of follicles, stimulation of follicular steroid production, increased gonadotropin receptor expression within follicles, and proliferation of theca and granulosa cells to form the corpus luteum after ovulation. Lactating cows typically have depressed IGF when compared to non lactating cows or heifers. Perhaps the reason that bST treatment increases pregnancy rates in lactating cows but not heifers is that it corrects a problem in lactating cows (low IGF) that does not exist in non lactating heifers.

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Treatment of heifers with bST treatment on Day 14, or on both Day 0 and 14, reduced (P = 0.009) pregnancy rate, when compared with the control and Day 0 bST treatment groups. Pregnancy rate was similar (P = 0.73) for heifers receiving bST on Day 14 versus Day 0 and 14. The reduction in pregnancy rates of heifers treated with bST on Day 14 or Day 0 and 14 is in agreement with Kamimura et al. (2002). Starting about Day 15, embryos produce interferon-tau which is the signal for pregnancy recognition. Thatcher et al. (2003) reported that in lactating dairy cows, bST and interferon-tau have additive effects in suppressing prostaglandin F2alpha, which is necessary for pregnancy maintenance. However, a similar effect was not found in non lactating cows. It is possible that the reduction in pregnancy rate noted for heifers treated on Day 14 or Day 0 and 14 in the present study could have been due to interference with normal pregnancy recognition signals. Since bST treatment sustains somatotropin for about 14 days, heifers treated on Day 0 would no longer be affected when pregnancy recognition is initiated on Day 15. Thus, treatment on Day 0 had no adverse effects.

Fetal growth, as measured by crown-rump length, was unaffected by treatment (P = 0.60). Mean progesterone on Day 14 ranged from 9.96 to 10.34 ng/ml and was not affected by bST treatment on Day 0 (P = 0.99). Although bST treatment has been reported to increase the length of elongating embryos on Day 17, this increased growth does not appear to translate in increased fetal size by Day 45 of gestation.

Literature Cited

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Table 1. Effect of bovine somatotropin (bST; Posilac) at and/or after insemination on pregnancy rates and fetal growth.

Treatment	No. of animals	No. Preg. (%)	C-R length (mm ± SEM)
Control	18	17 (94.4)[a]	25.5 ± 2.0
bST, D 0	19	16 (84.2)[a]	26.1 ± 4.1
bST, D 14	18	12 (66.7)[b]	27.4 ± 0.9
bST, D 0 and 14	18	11 (61.1)[b]	28.1 ± 0.9

[ab]Pregnancy rate among treatments differed (P = 0.009).