Observations on Intramammary Infection and Somatic Cell Counts in Cows Treated with Recombinant Bovine Somatotropin

Kerry D. Lissemore, Ken E. Leslie, Brian W. McBride, John H. Burton, Andrew R. Willan and Ken G. Bateman

ABSTRACT

Data were collected on udder health variables as part of a study of the effects of recombinant bovine somatotropin on production in lactating dairy cows. Milk samples, obtained at three intervals during the study, were assessed for their somatic cell count and bacteriological culture result. There was an increase in the prevalence of infection at mid-lactation in the 20.6 and 41.2 mg per day treatment groups as compared to the controls. There was no difference detected in the mean cell count between groups from the samples collected pretrial, mid-lactation, or late lactation. However, analysis of the individual cow Dairy Herd Improvement somatic cell count data showed a difference between groups which was most evident in mid-lactation.

RÉSUMÉ

Dans le cadre d'une étude conduite sur les effets de la somatotropine bovine sur la production laitière, des données ont été recueillies sur différentes variables ayant trait à la santé de la glande mammaire. Des échantillons de lait ont été prélevés à trois reprises durant l'étude et une culture bactériologique et un comptage des cellules somatiques ont été réalisés. Lorsque comparées aux témoins, les vaches des groupes recevant 20.6 et 41.2 mg/jr de somatotropine ont démontré une augmentation du nombre de cultures bactériologiques positives en mi-lactation. Par contre, aucune différence du nombre de cellules somatiques n'a été observée entre les échantillons prélevés avant le début de l'expérience, en mi-lactation et en fin de lactation. L'analyse individuelle des données à partir du programme d'amélioration du comptage des cellules somatiques chez les troupeaux laitiers a démontré une différence plus marquée du compte en mi-lactation parmi les vaches des différents groupes. (Traduit par Dr Pascal Dubreuil)

The effects of bovine somatotropin (BST) on milk yield and milk composition in lactating dairy cows are well documented (1-4). However, there are few reports on the changes in health status of BST-treated cows. The effects of BST treatment on health, in both short and long-term studies, were reviewed recently by Peel and Bauman (5). Their conclusion was that although it had previously been postulated that long-term treatment with BST may result in animal health problems, no reports document any adverse effects on bovine health. Recently, Eppard et al reported no negative effects on udder health, as measured by somatic cell counts (SCC) and clinical mastitis, in cows treated with BST (6). The objective of the present study was to observe the effects of BST treatment using three different dosages on intramammary infections and SCC.

Thirty-seven Holstein cows from the University of Guelph dairy research herd were randomly assigned at calving to one of four treatment levels of BST (2). The treatment groups were: 0, 10.3, 20.6 and 41.2 mg of BST per cow per day. The control group received sterile saline. All treatments were administered daily at 1030 h, by subcutaneous injection. The treatments commenced between days 28-35 postpartum and continued for 266 days. Cows were maintained in tie-stalls and milked daily at 0500 and 1600 h, in a double herringbone parlor using a low-line, automatic take-off milking system without backflush. Routine mastitis management of the herd included washing of the udders with disinfectant solution on individual towels before milking, germicidal teat dip applied postmilking, treatment of clinical cases with commercial antibiotic preparations and dry cow therapy. The cows were fed ad libidum one of three total mixed rations based primarily on corn silage and haylage balanced to National Research Council standards. The procedures followed the guidelines of the Guide to the Care and Use of Experimental Animals of the Canadian Council on Animal Care.

Quarter milk samples were collected aseptically from each cow three times during the study. The first sample was taken prior to the commencement of BST treatment at day 28 (pretrial). The second and third samples were collected between days 120 to 150 (mid-lactation), and days 240 to 266 (late lactation), respectively. Each quarter sample was analyzed for the SCC with a Coulter milk cell counter (Milk Cell Counter, Coulter Electronics, Hialeah, Florida) and was cultured according to standard bacteriological methods (7). The Ontario Dairy Herd Improvement Corporation (DHI) supervisor also collected a composite milk sample from each cow for a SCC determination using a Fossomatic cell counter

---

(Fossomatic, Foss Electric, Hillerod, Denmark) at each herd test.

A geometric mean SCC was calculated for each cow from the quarter SCC measurements. The natural logarithm (lnSCC) of the individual cow geometric mean SCC was used in the analysis. To test for an effect between treatment groups, the pretrial lnSCC was used as a baseline and was subtracted from the mid and late lactation values. Group effect was examined using an analysis of variance for repeated measures design (8).

Since treatment allocation was randomized by cow, each cow was classified as either negative or positive (based on the culture results of the quarter samples). A cow was classified as negative if no organisms were cultured from any quarter. If a major mastitis pathogen was cultured from one or more of the quarter samples, the cow was classified as positive. A one-tailed Fisher's exact test was used to analyze for differences between the control group and each of the treatment groups. There were five cows removed from the study that were not included in the last analysis due to missing samples. They represented one cow each from treatment groups 0, 10.3, 41.2 mg/day and two cows from the 20.6 mg/day treatment group.

The monthly DHI SCC results were logarithmically transformed and using the lnSCC values an analysis of variance for repeated measure design with unequal group size was performed (8). The first month DHI SCC result was excluded because not all cows were tested prior to the commencement of treatment. All analyses were performed using the Statistical Analysis System (SAS) (9).

The main SCC results for each treatment group calculated from the quarter samples collected pretrial, mid-lactation, and late lactation are presented in Table I. Only cows with complete data (n = 8) were used in the analysis of the effect of treatment on the SCC at mid and late lactation. This created an equal number of cows within each group at each time sampled. Although the pretrial mean SCC appeared to differ between treatment groups, the large standard deviation resulted in these differences being nonsignificant. Before the pretrial baseline SCC was subtracted, the anal-

TABLE I. Average somatic cell counts of bovine somatotropin (BST) treatment groups

| Test period | BST treatment group (mg/day) | | | |
| | 0 | 10.3 | 20.6 | 41.2 |
	Mean somatic cell count × 10³/mL (SD)			
Pretrial	491.70	371.49	275.76	424.31
	(769.14)	(374.98)	(187.24)	(428.99)
Mid-lactation	268.93	221.74	522.13	489.13
	(212.97)	(137.47)	(302.25)	(341.43)
Late lactation	869.61	656.26	831.48	1517.41
	(482.49)	(535.72)	(412.04)	(1569.93)

TABLE II. Milk culture results of bovine somatotropin (BST) treatment groups

| Culture results | BST treatment group (mg/day) | | | |
	0	10.3	20.6	41.2
Pretrial				
Number of cows	9(36)[a]	9(36)	10(40)	9(36)
Negative[b]	7(33)	8(34)	7(35)	5(31)
Positive[c]	2(3)	1(2)	3(5)	4(5)
Mid-lactation				
Number of cows	9(36)	9(36)	10(40)	9(36)
Negative	8(34)[1]	7(34)[1]	4(32)[2]	3(24)[2]
Positive	1(2)[1]	2(2)[1]	6(8)[2]	6(12)[2]
Late lactation[d]				
Number of cows	8(32)	8(32)	8(32)	8(32)
Negative	1(16)	3(26)	3(26)	1(18)
Positive	7(16)	5(6)	5(6)	7(14)

[a]Number of quarters in parenthesis
[b]No organisms cultured
[c]A major mastitis pathogen cultured in one or more quarters
[d]Data unavailable for five cows
[1,2]Number of cows in rows with different superscripts differ significantly from control group (p < 0.05)

ysis of variance performed indicated a marginal difference (p = 0.08) in the effect of group on the mean SCC at mid and late lactation. However, when the baseline value was subtracted prior to analyzing for differences between groups at mid and late lactation, the effect of group was not significant.

No significant difference was found in the point prevalence of infection between pretrial treatment groups (Table II). Milk culture results taken at mid-lactation showed an increase in the prevalence of infection with increasing dosages of BST. The differences in infection prevalence between the control group and the 20.6 mg BST per cow per day group, as well as between the control group and the 41.2 mg BST per cow per day group were both significant at (p<0.05) (Table II). No difference was detected in the infection prevalence among groups during late lactation (Table II) due to the large increase in the number of culture positive cows in the control group at this time. The predomi-

nant mastitis pathogen cultured during the study was Staphylococcus aureus. The other organisms were Corynebacterium bovis, Escherichia coli, and coagulase-negative staphylococci. No differences were found among groups in types of pathogen isolated.

A total of seven monthly DHI SCC test results were analyzed for an effect of treatment between groups over time. The analysis showed that there was a significant difference between groups (p<0.05) and that there was a group by month interaction (p<0.01). The transformed DHI SCC data are graphically presented in Fig. 1.

These observations on the prevalence of intramammary infection and the SCC data indicated a potential negative effect on udder health from higher dosages of BST treatment. Even though there was an increased infection prevalence at mid-lactation, there was no significant difference in the mean SCC between treatment groups. However, analysis of the DHI SCC data did reveal a difference between
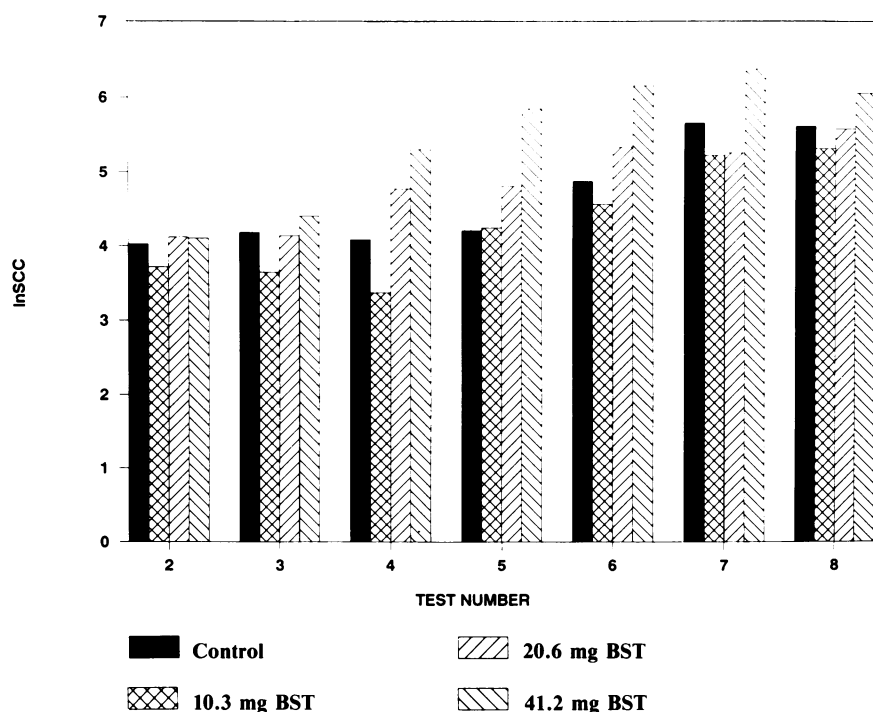
Fig. 1. Natural logarithms of Dairy Herd Improvement Corporation somatic cell counts (ln SCC) by test at each bovine somatotropin (BST) treatment level.

health of BST treated cows indicates the need for further research. Future studies on the relationship between BST treatment and cow health will require not only a larger number of cows but also a substantial number of herds to account for herd level variability.

REFERENCES

1. **BAUMAN DE, EPPARD PJ, De GEETER MJ, LANZA GM.** Responses of high-producing dairy cows to long-term treatment with pituitary somatotropin and recombinant somatotropin. J Dairy Sci 1985; 68: 1352-1362.
2. **BURTON JH, McBRIDE BW, BATEMAN K, MacLEOD GK, EGGERT RG.** Recombinant bovine somatotropin: Effects on production and reproduction in lactating cows. J Dairy Sci 1987; 70(Suppl. 1): 175.
3. **PEEL CJ, SANDLES LD, QUELCH KJ, HERINGTON AC.** The effects of long term administration of bovine growth hormone on the lactational performance of identical twin dairy cows. Anim Prod 1985; 41: 135-142.
4. **RICHARD AL, McCUTCHEON SN, BAUMAN DE.** Responses of dairy cows to exogenous bovine growth hormone administered during early lactation. J Dairy Sci 1985; 68: 2385-2389.
5. **PEEL CJ, BAUMAN DG.** Somatotropin and lactation. J Dairy Sci 1987; 70: 474-486.
6. **EPPARD PJ, BAUMAN CR, CURTIS CR, ERB HN, LANZA GM, De GEETER MJ.** The effect of 188-day treatment with somatotropin on health and reproductive performance of lactating dairy cows. J Dairy Sci 1987; 70: 582-591.
7. **BROWN RW, MORSE GE, NEWBOULD FHS, SLANETZ LW.** Microbiological procedures for the diagnosis of bovine mastitis. National Mastitis Council, 1969.
8. **WINER BJ.** Statistical Principles in Experimental Design. Second Edition. New York: McGraw-Hill Book Co., 1962.
9. **STATISTICAL ANALYSIS SYSTEM.** SAS User's Guide: Statistics. Cary, North Carolina: SAS Institute, 1982.
10. **DOHOO IR, MEEK AH.** Somatic cell counts in bovine milk. Can Vet J 1982; 23: 119-125.

groups during mid-lactation. The lack of agreement in the results between these two sources of SCC data may be related to sampling differences, machine differences and individual cow variability (10). There have been no other reports in the literature on an effect of BST treatment on udder health. It is important to note that in this trial BST treatments commenced at day 28, differing from another study that examined health effects in which treatments were initiated at approximately 84 days postpartum (6). It is possible that exposure of cows to BST treatment during early lactation may have had an indirect negative effect on udder health. Although this hypothesis cannot be substantiated from the available data, the longer duration of treatment may explain why other workers have not observed similar results. The limited number of animals per treatment group makes detection of any effects on udder health difficult, which is in agreement with the conclusions of Eppard et al (6). Furthermore, the data in this study should be interpreted with caution. Not only were numbers limited, but these observations were based on data from one herd. The influence of herd variables on the effects of BST are unknown at this time. However, despite the limitations of the study, the importance of any potential effects on the udder