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The use of somatic cell counts to identify cows with subclinical mastitis at calving

Abstract

The dynamics of somatic cell counts during the first 10 days in milk were compared among udder quarters of cows with intra-mammary infection at the time of calving and those with no infection present. The study group consisted of 81 cows calving at the Kansas State University dairy research herd between July of 1998 and February of 1999. Cows with an intramammary infection had greater, average, somatic cell counts at calving, and this difference continued throughout the 10-day period. Using a breakpoint of 1,000,000 somatic cells/ml at calving to select animals for culture would have correctly selected 81% of the quarters that were actually infected with major mastitis pathogens.; Dairy Day, 1999, Kansas State University, Manhattan, KS, 1999;

Keywords

Dairy Day, 1999; Kansas Agricultural Experiment Station contribution; no. 00-136-S; Report of progress (Kansas Agricultural Experiment Station and Cooperative Extension Service); 842; Dairy; Somatic cell count; Intramammary infection; Calving

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THE USE OF SOMATIC CELL COUNTS TO IDENTIFY COWS WITH SUBCLINICAL MASTITIS AT CALVING

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M. E. Scheffel, and A. F. Park

Summary

The dynamics of somatic cell counts during the first 10 days in milk were compared among udder quarters of cows with intra-mammary infection at the time of calving and those with no infection present. The study group consisted of 81 cows calving at the Kansas State University dairy research herd between July of 1998 and February of 1999. Cows with an intramammary infection had greater, average, somatic cell counts at calving, and this difference continued throughout the 10-day period. Using a breakpoint of 1,000,000 somatic cells/ml at calving to select animals for culture would have correctly selected 81% of the quarters that were actually infected with major mastitis pathogens.

(Key Words: Somatic Cell Count, Intra-mammary Infection, Calving.)

Introduction

Mastitis is the most costly disease of dairy cattle because of economic losses from reduced milk production, treatment costs, increased labor, milk withheld following treatment, premature culling, and decreased genetic improvement. Clinical mastitis is characterized by abnormal milk, with or without additional signs of illness. Subclinical mastitis is defined by intramammary bacterial infection without signs of abnormal milk or illness, therefore, and may, be more difficult to recognize. The pathogens that cause mastitis may be classified as those that are contagious in nature and primarily spread from

cow to cow and those that are acquired from the environment. The risk period for new infection varies with the pathogen involved. New infections with contagious pathogens are more likely to occur during the milking period, and new infections with environmental pathogens are more likely to occur during involution of the udder during the early dry period (particularly the environmental *Streptococcus* spp.) and during the period surrounding calving (*E. coli*).

Over the past decades, tremendous advances have been made in udder health management. Control measures include the use of pre- and postmilking teat dipping, dry cow therapy, segregation and culling strategies for chronically infected animals, and environmental control during the dry cow and calving periods. Each of these control measures is aimed at the management of specific pathogens. Postmilking teat dipping is aimed at preventing new infections during the milking period, and dry cow therapy is used to cure infections present at the time of dry-off and to prevent new infections during the early dry period. Environmental control during the dry period and calving period is targeted primarily at preventing new infections with environmental (*Streptococcus* spp.) and coliform bacteria (e.g., *E. coli*, *Klebsiella*), respectively. Therefore, the status of intramammary infections at calving and the specific pathogen implicated would provide a means of monitoring the effectiveness of existing udder control programs and assessing the usefulness of new mastitis control strategies.

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Bacteriological culture is the standard for identifying subclinical infection. However, logistic and financial considerations involved in sampling all cows at the time of calving have precluded widespread adoption of this strategy in the dairy industry. If an effective means to identify fresh cows at a high risk of having intramammary infections could be found, it would increase the efficiency and perhaps the adoption of this management aid. Previous studies have examined the usefulness of somatic cell count (SCC) results from DHI sampling as a means of identifying potentially infected cows. However, this strategy has proven to have limited use, because routine testing is performed on composite samples rather than samples from individual udder quarters. In addition, samples are obtained on a monthly basis from cows that are at least 5 days in milk. This means that cows are sampled for the first time between 5 and 35 days, which in some cases may be too late after calving to provide meaningful information.

A recent study of Dutch Holstein cows reported that SCC evaluation of quarter milk samples during the early postcalving period might be an effective means of identifying high-risk cows for further bacteriological examination. Many DHI organizations will provide SCC evaluations on milk samples submitted by producers, potentially allowing information to be obtained for cows at any stage of lactation. Therefore, the potential exists to use SCC to select cows (or quarters) for further culture analysis. If validated, such sampling would provide the necessary information on which pathogens were present in the herd at calving to monitor udder health programs for dry cows. At the same time, the selective nature of the sampling would reduce the number of noninfected cows subjected to the time and expense of milk culturing.

The objectives of the present study were to examine the use of SCC as a means of identifying intramammary status at calving and to identify the ideal sampling times to maximize the ability to identify infected cows for further bacteriological examination.

Procedures

The study group consisted of multiparous cows calving at the Kansas State University dairy. Milk samples for bacteriological culture were collected from each udder quarter of each cow during the first 12 hours after calving. In addition, quarter samples were collected once daily for 10 days at the morning milking for SCC evaluation. Somatic cell count evaluations were performed by the Heart of America DHI, Manhattan, KS.

The milk samples for bacteriological culture were frozen immediately after collection and sent weekly to the diagnostic laboratory at Kansas State University. After the samples were thawed, a swab was used to plate the milk on blood agar and MacConkey agar. Plates were incubated aerobically at 37°C and examined for growth 24 and 48 hrs later. Colonies were identified using standard laboratory procedures for mastitis pathogens.

The dynamics of SCC during the first 10 days in milk for quarters with and without intramammary infection at the time of calving were compared and analyzed statistically using analysis of variance for repeated measures. The usefulness of SCC for determining infection status was evaluated further using break-point analysis. For SCC to be useful as an aid in determining intramammary infection at calving, the majority of quarters with intramammary infection also must have high SCC. Therefore, hypothetical break points were created for selecting quarters based on their SCC for culture analysis. This information was combined with the actual culture results to determine the percentage of infected and noninfected animals above each break point. Because the majority of udder control programs are targeted towards the control of major mastitis pathogens, the infected cows were classified further as having major or minor pathogens.

Results and Discussion

A total of 81 cows was included in the study. All of the cows calved between July 15, 1998 and February 19, 1999. One cow

died 5 days after calving, and four cows that calved had only three functional quarters. Of the 324 quarters cultured, 78 were infected with one bacterium, and four were infected with two bacteria. The most frequently identified bacteria were nonhemolytic *Staphylococcus* spp. The significance of these bacteria for udder health is still unclear. Of the 23 major mastitis pathogens identified, 17% were contagious in nature (*Staphylococcus aureus*), and 83% were environmental pathogens (environmental *Streptococcus* spp., *E. coli*, or *Klebsiella*). The relative frequency of different pathogens would be expected to differ among herds, depending on factors such as the area, management, and udder health programs.

Figure 1 shows average SCC by days in milk for infected and noninfected quarters. Average SCC decreased during the first 10 days in milk in both groups. Quarters that were infected with any pathogen at the time of calving had an average SCC of 2,666,000 compared to an average SCC of 1,211,000 in noninfected quarters. Infected cows had greater ($P<0.001$) average SCC throughout this period, and the count did not decline ($P<0.001$) as quickly over time as that for the noninfected quarters.

Despite significant differences in the average SCC between infected and noninfected quarters, considerable variation existed in the SCC of individual quarters. Table 1 shows the percentages of quarter milk samples exceeding SCC break points of 250,000, 500,000, or 1,000,000 cells/ml for quarters infected with major pathogens, quarters infected with minor pathogens, and culture negative quarters at calving and at 5 and 10 days in milk. Based on these results, if one were to sample all quarters of all cows for SCC at the time of calving and use a break point of 250,000 cells/ml to further select quarters for milk culture, one would correctly select all of the quarters infected with major pathogens. However, using this criterion also would result in large numbers of noninfected quarters being selected for culture, increasing the cost and lessening the efficiency. Using a more stringent break point of 1,000,000 cells/ml to select quarters for culture would correctly select 81% of the quarters actually infected with major pathogens and only 32% of the noninfected quarters. The use of this break point seemed to be the most efficient sampling strategy.

Table 1. Percentages of Quarter Milk Samples with an SCC 250,000, 500,000, or 1,000,000 Cells/ml in Quarters Infected with Major Pathogens, Quarters Infected with Minor Pathogens, and Culture Negative Quarters at Calving and 5 and 10 Days in Milk

Item	Calving	Day 5	Day 10
Break point of 250,000 cells/ml			
Major pathogen	100	65	45
Minor pathogen	76	38	31
Not infected	82	11	9
Break point of 500,000 cells/ml			
Major pathogen	88	53	35
Minor pathogen	67	29	24
Not infected	54	6	4
Break point of 1,000,000 cells/ml			
Major pathogen	81	24	25
Minor pathogen	50	18	13
Not infected	32	4	2

Figure 1. Average Somatic Cell Count by Days in Milk for Infected and Noninfected Quarters.

