Dairy Herd Mastitis Quality Control Program

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ABSTRACT

Milk from 34 dairy herds was tested over a 12-month period using a mastitis evaluation program in which Streptococcus agalactiae, Staphylococcus aureus and leucocytes were counted. There was a significant decrease in the total mastitic bacterial count (S. agalactiae plus S. aureus) over the testing period; however, the curve was bimodal, showing high points in the winter and summer months. The leucocyte count alone was not a good indicator of the mastitic condition of the herd. In approximately 12% of the test results, there was a high bacterial count with a low leucocyte count or a high leucocyte count with a low bacterial count.

Regulations require that milk shall come from healthy cows, thus excluding milk from mastitic cows. In the broad sense, mastitis includes any udder infection that results in milk that is abnormal in its composition and properties. The major reasons for controlling mastitic infections are: (a) their relation to the healthfulness of the milk, (b) the effect on esthetic appeal, flavor and other properties of milk, (c) the effect on the productivity of the cow and (d) the effect of attempted treatments on the processing qualities of the milk.

Depending upon the stage of the mastitis, the number of mastitic bacteria in milk ranges from less than 1000 to several hundred million per milliliter. Streptococcus agalactiae has been reported to be the most common cause of chronic mastitis in dairy cattle and Staphylococcus aureus the major microorganism associated with unsanitary equipment or damaged udder infections. Concentrations of leucocytes in excess of 5 x 105/ml are generally considered to be indicative of mastitis or some other abnormality. Many methods are used to screen dairy herds for subclinical and clinical mastitis.

et al. (2) presented a review of current and most widely used screening and confirmatory methods for detecting abnormal milk. Giesecki and Van den Reever (1) presented an excellent review on methods used to detect subclinical mastitis.

This paper presents a dairy herd mastitis quality control program based on counts of S. agalactiae, S. aureus and leucocytes. The program requires the cooperation of the testing or dairy processing plant laboratory manager, dairy herd manager and herd veterinarian.

MATERIALS AND METHODS

Mastitis monitoring program

Milk from 34 dairy herds was tested for mastitis, by using S. agalactiae and S. aureus counts and the leucocyte count, once a month for 12 months. Upon completion of each monthly test, each herd manager was notified of the results and the possible corrective actions necessary.

Media and culture conditions

Streptococcus agalactiae. The medium used for enumeration of S. agalactiae was developed in our laboratories. The Park-Morgan medium (per 1000 ml) consisted of: lactose broth (Difco), 13 g; Standard Plate Count agar (Difco), 23.5 g; methyl violet (2B) 0.1 g; thallium (thallous) acetate (K & K Laboratories, Inc.), 0.4 g; bromothymol blue (J. T. Baker Chemical Co.), 3 ml of a 1.0% solution; bromocresol purple (J. T. Baker Chemical Co.), 2 ml of a 1.0% solution; and human plasma (expired), 5% by volume.

Methyl violet was prepared by adding 0.1 g of crystals to 100 ml of distilled water. Bromothymol blue and bromocresol purple solutions were prepared by adding 1.0 g of each to separate bottles containing 59 ml of distilled water and 40 ml of methanol.

Human plasma (expired) was purchased from a local blood bank. A large quantity can be purchased, aseptically repackaged into smaller containers (approximately 25 ml in a Whirl-Pak bag) and frozen (-20 C) until needed for media preparation.

Suspend the lactose broth, Standard Plate Count agar and thallium acetate in 1000 ml of cold distilled water. Add the methyl violet, bromothymol blue and bromocresol purple and heat to boiling to completely dissolve the medium. Sterilize for 15 min at 15 psi (121 C). Cool to approximately 50 C. Add 5% by volume, of human plasma (expired) immediately before pouring plates. Do not reheat media after adding the plasma. Pour 8-10 ml of medium into one side of a
two-compartment petri dish. Plates were stored at 4-10°C and were less than 5 days old at the time of streaking.

**Staphylococcus aureus.** Tellurite glycine agar (Difco) enriched with human plasma was used for enumeration of *S. aureus*. The formula (per 1000 ml) consisted of tellurite glycine agar (Difco), 62.5 g; potassium tellurite (Matheson, Coleman, and Bell Co.), 20 ml of a 1.0% solution; and egg yolk or human plasma (expired), 2% by volume.

Prepare potassium tellurite by adding 1.0 g of potassium tellurite crystals to 99 ml of distilled water and sterilizing for 15 min at 15 psi (121°C).

To obtain aseptic egg yolk, boil an egg 2 min, carefully remove the top portion of the egg (pouring out excess egg white) and then extract the desired amount of yolk with a sterile syringe (with the needle removed). Expired human plasma was prepared as described above.

Suspend 62.5 g of tellurite glycine agar in 1000 ml of cold distilled water. Heat to boiling to completely dissolve the medium, then sterilize 15 min at 15 psi (121°C). Cool to approximately 50°C and add potassium tellurite solution and egg yolk (or human plasma) immediately before pouring plates. (Do not reheat medium after adding the potassium tellurite solution and egg yolk or human plasma.) Pour 8-10 ml of medium into the other side of the petri dish already containing the Park-Morgan medium. Plates were stored at 4-10°C and were less than 5 days old at the time of streaking.

**Bacterial count**

Streak a 0.01-ml sample of milk on each medium, using a 0.01 ml loop. Cover the plate as evenly as possible with the sample. Flame the loop between each sample. Incubate the plates 48 h at 35°C.

**Appearance of colonies**

The appearance of the colonies growing on each medium is of importance, and the following criteria were used in this study: (a) Park-Morgan medium (*S. agalactiae*): color - pale yellow to brownish with a yellow halo (required); type - glossy, smooth, circular. size - 1 mm or smaller. Any other colony growing on this medium was not considered *S. agalactiae*. (b) Tellurite glycine agar (*S. aureus*): color - black (sometimes steel gray), type - glossy, smooth, circular - may or may not have a hemolytic zone, size - must be larger than 0.5 mm. Any other colony growing on this medium was not considered *S. aureus*.

**Leucocyte count**

The leucocyte count was determined on each sample, using the Wisconsin mastitis test procedure (3) after the microbial analysis described above.

### RESULTS AND DISCUSSION

Milk quality, as measured by *S. agalactiae* and *S. aureus* counts, improved over the 12-month testing period. The average combined bacterial count for each herd at the beginning and end of the testing period was 5300 and 4200, respectively. The decline in bacterial counts (Fig. 1) was bimodal, showing high points in the winter and summer months. The lower points on the curve were 2800 and 2400 for spring and fall, respectively.

The average leucocyte count also decreased over the testing period. The average herd leucocyte count at the beginning of the testing period was 3550,000 and was 430,000 at the end. Again the curve over the entire testing period was bimodal, repeating approximately the same form as the average combined bacterial counts although off-set or delayed (Fig. 1). This suggests leucocyte persistence 2-3 weeks beyond the infection stage.
subprimals are used. When vacuum-packaged strip loins were fabricated at Day 14 or Day 28 after arrival, MGA-packaging was not comparable to PVC-packaging for protecting appearance of retail steaks. Whether the effect of postmortem aging time or of vacuum-packaging has the greatest effect on the retail appearance of MGA-packaged steaks was not delineated in this study. Further research to document the effects of postmortem age—from an early time postmortem and at shorter time intervals thereafter—and the effects of previous packaging history are necessary to fully understand the factors necessary for successful storage and display of steaks in modified gas atmospheres.

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REFERENCES


Figure 3. Comparison of average combined S. agalactiae and S. aureus counts vs. leucocyte count for 34 dairy herds in a mastitis quality control program. Adjusted slope reflects change in the curve when observed results of high bacterial count with low leucocyte count and low bacterial count with high leucocyte count are not included in calculations.

Of the test results, 11.8% showed a very high bacterial count with a low leucocyte count or a very high leucocyte count with a low bacterial count. When these results are excluded, the accelerated curve begins at the 800,000 leucocyte count point (Fig. 3). This shows that the leucocyte count alone does not give a true indication of a herd’s mastitic condition.

When S. agalactiae and S. aureus counts are used together with the leucocyte count, they give a good indication of the type of mastitic problem, the stage of the problem and the necessary corrective action. Also, low results from all three parameters forecast that problems associated with mastitic infection would be minimal.

REFERENCES