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G93-1151 The Somatic Cell Count and Milk Quality

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The Somatic Cell Count and Milk Quality

This NebGuide describes what somatic cells are, and their significance related to mastitis and milk quality.

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The somatic cell count (SCC) is commonly used as a measure of milk quality. Somatic cells are simply animal body cells present at low levels in normal milk. High levels of these cells in milk indicate abnormal, reduced-quality milk that is caused by an intramammary bacterial infection (mastitis).

The majority of the cells in a somatic cell count are leukocytes (white blood cells), and some are cells from the udder secretory tissue (epithelial cells). The epithelial cells are part of the normal body function and are shed and renewed in normal body processes. The white blood cells serve as a defense mechanism to fight disease (infection), and assist in repairing damaged tissue.

Milk markets routinely rely on somatic cell counts to help ensure a quality product. SCC levels are monitored to assure compliance with state and federal milk quality standards. Today, most markets pay a premium for low SCC, good-quality milk.

One can appreciate the reasons for paying a bonus for quality milk when the relationship between mastitis (high SCC) and milk composition is understood. Chemical changes in milk composition, due to mastitis, reduce milk quality.

For example, milk with high SCC causes a rise in whey proteins and a decrease in casein, resulting in considerably decreased cheese yields. Shorter (or decreased) shelf life and adverse milk flavors are the common results of an elevated SCC score. High SCC increases undesirable components and decreases the desirable components of milk.

Beginning July 1, 1993, the SCC level in milk quality regulations must be less than 750,000 SCC to

comply with the State and Federal Pasteurized Milk Ordinance. A violation of the PMO makes the milk non-marketable.

The development of electronic somatic cell counting equipment and computer network technology has made somatic cell counts readily available to most dairy producers. Some markets provide an SCC score for every pickup of milk, providing continual monitoring. Those enrolled in the Dairy Herd Improvement (DHI) program can receive individual cow and whole herd SCC data each month. The data provide information regarding the infectious status (mastitis) and daily money losses from this disease, for each lactating cow in the herd.

Somatic cell counts are based on the number of cells per milliliter (ml, about 10 drops) of milk. Since such large numbers are used, an alternative linear score system was developed and sometimes is used for various SCC ranges. Linear scoring uses 0-9 digits. As a single number increases by one digit, SCC doubles.

For example, a linear score of 2 is equivalent to an SCC of approximately 50,000. Increasing the linear score to 3 would indicate an SCC of approximately 100,000.

Table I shows the relationship of SCC, linear scores, and approximate weight loss of milk at each level. An important advantage of the linear score is its straight line relationship with milk yield (loss).

Table I. Conversion of cell count to linear score and associated milk loss

Linear Cell Count Score	Cell Count (Thousands)		Yield Loss (lb/day)	Approx. Lactation lb/yr
	Mid-Point	Range		
0	12.5	0 - 17		
1	25	18 - 34		
2	50	35 - 70	0	0
3	100	71 - 140	1.5	400
4	200	141 - 282	3.0	800
5	400	283 - 565	4.5	1200
6	800	566 - 1130	6.0	1600
7	1600	1131 - 2262	7.5	2000
8	3200	2263 - 4525	9.0	__
9	6400	4526 -		

Causes of a High Somatic Cell Count

High SCC levels are abnormal and undesirable. Elevated SCC levels may result from several factors or a combination of these factors:

1. **The mammary gland is infected with mastitis-causing organisms:**

The major factor that causes elevated SCC is an infection of the mammary gland. This cell count is applicable to the quarter, cow, or bulk tank somatic cell count (BTSCC). An increased BTSCC is related to increased herd infection prevalence and decreased milk production.

The normal SCC in milk is generally below 200,000 per ml, but may be below 100,000 in first lactation animals or in well-managed herds. An SCC above 250,000 - 300,000 is considered abnormal and nearly always is an indication of bacterial infection causing inflammation of the udder.

The most common organisms that infect the milk-producing gland are classified into two groups: 1) contagious pathogens and 2) environmental pathogens. The contagious pathogens (*Staphylococcus aureus, Streptococcus agalactiae*, and some others) generally cause the greatest SCC increase. An infection by an environmental pathogen (non *Strep. ag Streptococcus, Corynebacterium bovis*, and coagulase negative Staphylococcus) usually causes considerably less SCC elevation. However, SCC range between individual infected cows can be quite broad.

2. **Cow age and stage of lactation:**

General observation implies that SCC increases with advancing age and stage of lactation. Eberhart and coworkers at The Pennsylvania State University separated cows into groups by infection status. They found little obvious change in SCC either in late lactation or as a cow ages in *uninfected cows*, i.e., if SCC is high an infection exists in the mammary gland.

Elevated SCC may occur in milk in late gestation and for a few weeks following calving, regardless of infection status. This SCC elevation appears to be part of a cow's natural immune system response in preparation for calving, to enhance the mammary gland defense mechanisms at this critical parturition time. Quarters with no infections generally have a rapid decline in SCC within a few weeks postpartum.

3. **Stress and season:**

Stresses of various types and estrus (heat cycles) have been implicated in causing increases in SCC. However, research attempts to experimentally induce SCC changes in uninfected cows have shown only modest or no effects on milk SCC.

SCC levels usually are lowest in a clean, dry, comfortable environment. Weather and management factors play an important part relative to the control of mastitis. *Mastitis control principles must be maintained at all times.* The increased incidence of clinical mastitis (udder infection that shows visible signs) in the summer months is generally due to a warm and moist environment that increases pathogen exposure and numbers. The animal stress of high temperatures and excess humidity also may increase susceptibility to new infection and thus, higher SCC.

4. **Udder injury:**

Tissue damage from injury in the individual cow may temporarily elevate SCC even without infection. Such instances usually would be of short duration and improve as healing occurred. Damaged tissue is quite susceptible to infection so prevention of injury is important--eliminate ledges, debris, slick floors, etc.

5. **Indirect causes:**

Poor milking procedures contribute heavily to new rate of infection due to transmission of the disease at milking time. The result is an elevated SCC.

Faulty milking equipment due to poor installation or maintenance can cause tissue trauma, teat damage, poor milkout, erratic vacuum levels, etc; and also can transmit infectious agents at milking time. A complete system analysis should be conducted by competent equipment personnel at least twice a year (every six months) or after every 1,000 hours of system operation to minimize such dangers.

Extraneous voltage causes cow apprehension, teat irritation, uneasiness and poor milkout. These conditions contribute to new mastitis problems and elevate SCC in most cases.

Do Other Disease Problems Elevate Somatic Cell Counts?

Infections in other parts of the animal can only increase white blood cell counts, not somatic cell counts. The defense mechanism response in an animal is directed to where the infection is located. When the mammary gland is infected or severely bruised, the milk generally will incur an increased SCC until healing occurs or the udder infection is eliminated.

Temporary increase in SCC may occur just after calving as the udder adapts from non-lactating to lactating status.

Monitoring Somatic Cell Counts

Systematic records of SCC, monthly screening tests on individual cows, and tank milk SCC provide useful management information to the producer, veterinarian and other mastitis control team members. Monitoring SCC levels does not diagnose the exact cause or kind of bacterial infection present, but alerts the producer that there is a serious problem. The SCC provides a tool to determine progress of a control program.

In monitoring SCC levels, herd trends over several months are far more important than individual scores. In most herds, daily variations of up to 100,000 are not uncommon, highlighting the necessity of watching long-term trends to monitor herd mastitis level.

The DHI SCC program allows monitoring trends affecting mammary gland infection for individual cows. Data are helpful in locating problem sources or locations on a particular farm.

Reasons for a somatic cell monitoring program include:

1. it allows regular monitoring of the mastitis level of the herd and allows producers to follow SCC trends;
2. it helps identify cows with subclinical (infection exists but with no visible signs) mastitis;
3. it assists producers in making milking-order decisions to help prevent disease transmission during milking time;
4. it aids in identification of cows for treatment, drying off or culling;
5. it allows evaluation of mastitis level and duration, and effectiveness of control procedures, by tracking progress of program;
6. it aids in identifying problem areas in a given dairy installation;
7. it produces educational and management programs for training of milker personnel;
8. it determines SCC levels of cows to be purchased; don't buy infected cows, cows with SCC scores

over 300,000, or cows with a CMT-positive quarter.

The California Mastitis Test

The California Mastitis Test (CMT) is a rapid, accurate, cow-side test to help determine approximate somatic cell concentrations in milk. It is sensitive, rapid and inexpensive, primarily developed for sampling cow quarters, but also can be used on "bucket" and "bulk tank" milk samples to help determine the SCC range of that milk. (See *NebGuide G81-556*.)

Summary

The predominant factor affecting herd or individual cow SCC level is intramammary infections. The causes of infections are many and the method of transmission is virtually never a single factor, but a combination of many factors.

Analysis of these factors, combined with herd history, cow environment, and bacteriological culture information provides valuable guidelines for better management decisions that can prevent problems and reduce some misconceptions concerning changes in somatic cell counts.

Publications and visual aids concerning herd and individual factors affecting mastitis level and high SCC are available from the University of Nebraska-Lincoln Cooperative Extension Division.

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