

How low can you go? Understanding somatic cell count.

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Somatic cell count (SCC) is an index for milk quality and estimating the mammary health of dairy animals worldwide.

A high value of SCC in milk can be a problem, as it is an established indicator of an infection in the udder, such as mastitis. Mastitis can cause inflammation of the udder, resulting in decreased milk production, poor milk quality, higher antibiotic use in cows, and even the culling of the cow in severe cases. Furthermore, high SCC can also indicate lower animal welfare, as it is often associated with pain and discomfort for the cow.

A low SCC milk is associated with better milk quality. Milk processors often pay a lower price for milk with high SCC or may even reject it, leading to economic losses for dairy farmers. Thus, a low SCC is a desirable characteristic in milk production and manufacturing.

Controlling and reducing SCC is important to maintain a healthy and profitable dairy operation. Some strategies for achieving a low SCC include proper milking hygiene, regular herd health monitoring, early detection and treatment of infections, and good nutrition and management practices for the cows.

SCC is measured in milk per milliliter (cells/mL). The legal limit for SCC in milk in the United States is 750,000 cells/mL for grade A producers. However, test-day data from all herds enrolled in Dairy Herd Improvement analyzed by the Council on Dairy Cattle Breeding shows that the percentage of herd test days that exceeded 750,000, 600,000, 500,000, and 400,000 cells/mL during 2021 was 1.2, 2.5, 4.4, and 8.5, respectively, showing favorable declines in the last two years. More details on milk somatic cell count from dairy herd improvement herds and variation by states can also be found here: [Somatic Cell Counts of Milk from 2021 DHI Herds \(uscdcb.com\)](https://www.uscdcb.com)

● What is a Somatic Cell?

Somatic cells are a mixture of milk-producing and immune cells that are usually present and secreted during milking. Most of these cells in normal milk are cells from the udder secretory tissue (epithelial cells), and some are leukocytes (white blood cells such as polymorphonuclear neutrophils (PMNs), lymphocytes, and macrophages).

Epithelial cells in milk result from the desquamation of the mammary epithelium of the alveoli and the ducts. The presence of such cells in milk is a normal physiological phenomenon and necessary for the regeneration of normal epithelia.

PMNs are important in the early stages of the immune response, and they can quickly migrate to sites of infection and inflammation and engulf and destroy invading pathogens.

Macrophages are a type of immune cell that can engulf and digest foreign particles, such as bacteria and viruses, and cellular debris. They play a crucial role in the later stages of the immune response by clearing away dead cells and promoting tissue repair.

Lymphocytes are related to the body's ability to recognize and remember specific pathogens (such as viruses or bacteria) and mount a targeted response against them.

• SCC Healthy Levels

An SCC of 100,000 cells/mL in cow's milk is considered low and indicates good udder health. However, it is important to note that SCC can fluctuate over time and may be affected by various factors such as cow's age, stage of lactation, breed, and environmental conditions. As a result, dairy farmers need to monitor the SCC of their herds regularly so they can take appropriate measures to maintain/decrease SCC levels.

In a healthy gland, milk with 100,000 cells/mL will have 80% of the cells as a macrophage and 20% or less as neutrophils. However, during the inflammatory process, leukocytes migrated significantly to the area of inflammation, making it possible to use the cellularity of the milk to monitor the health of the mammary gland. An arbitrary value of 200,000 cells/mL is usually the cut-off point to distinguish subclinical mastitis and a healthy mammary gland. Thus, when there is inflammation by an infectious process, the number of neutrophils will represent up to 90% of the somatic cell count due to their phagocytic action at the infection site, as shown in **Table 1**.

Table 1. Blood and milk cells count in healthy, mastitic, and newly calved cows (adapted from Alhussien *et al.*, 2016; DOI: 10.17221/63/2015-CJAS).

Source	Parameters	Healthy udder	Subclinical mastitis	Clinical mastitis	Calving
Blood	Total Leucocyte count (x10 ³ /μl)	7.8 ^a ± 0.1	11.3 ^b ± 0.2	13.0 ^c ± 0.1	11.8 ^d ± 0.1
	Neutrophils (%)	27.1 ^a ± 0.2	32.8 ^b ± 0.5	39.0 ^c ± 0.1	35.3 ^d ± 0.4
	Lymphocytes (%)	58.2 ^a ± 0.2	52.1 ^b ± 0.4	45.6 ^c ± 0.3	49.3 ^d ± 0.3
Milk	Somatic Cell Count (x10 ⁵ cells/ml)	1.6 ^a ± 0.4	4.6 ^b ± 0.4	7.5 ^c ± 0.5	4.0 ^d ± 0.1
	Neutrophils (%)	19.3 ^a ± 0.2	43.1 ^b ± 0.4	75.8 ^c ± 0.4	67.8 ^d ± 0.6
	Lymphocytes (%)	14.9 ^a ± 0.2	11.4 ^b ± 0.2	7.8 ^c ± 0.4	10.8 ^d ± 0.2
	Macrophages (%)	65.5 ^a ± 0.5	45.4 ^b ± 0.5	17.0 ^c ± 0.4	19.3 ^d ± 0.4

Values with different superscript letters within a row are significantly different (p<0.05)

• How does SCC work?

When we think about mammary gland protection, it is important to remember we have the anatomical parts (e.g., Furstenberg rosette, teat orifice, and canal along with sphincter) functioning as the primary defense (**Figure 1**) and then the somatic cells as the second line of defense.

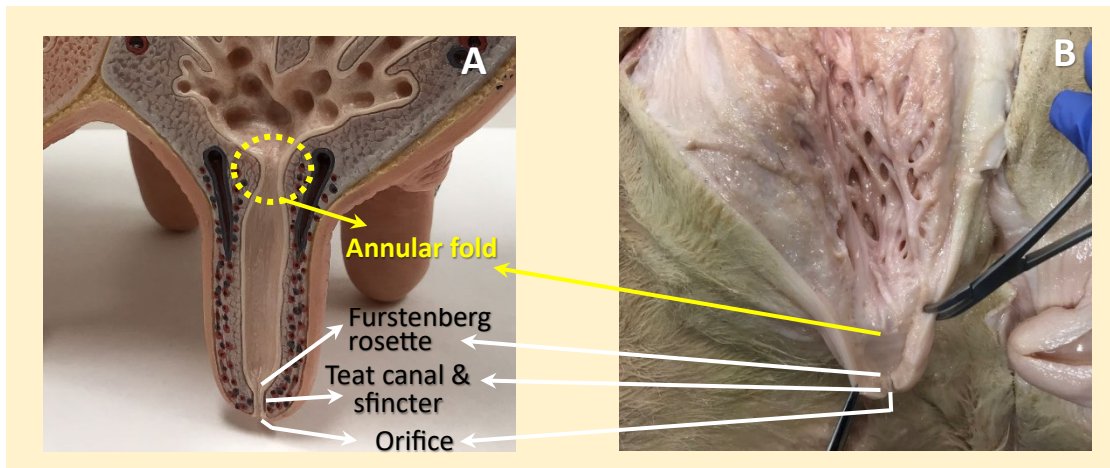


Figure 1. The internal teat structure works as the first line of defense that prevents pathogens entering the gland. (A) udder model, and (B) udder dissection.

When the udder is infected, white blood cells move to the udder from the bloodstream into mammary tissue to defend against the invading bacteria. This process is very important; without it, the elimination, even for those mild cases of mastitis, would be very slow, and consequently, tissue damage would increase.

- **Bellow threshold levels**

Research has no definite consensus that a cow with a count below 50,000 cells/mL does not respond efficiently to infection. A recent study even shows (**Figure 2**), when doing a molecular analysis to differentiate SCC (combined proportion of PMN and lymphocytes expressed as a percentage of the total) of those milk samples, that despite the very low SCC ($\leq 50,000$ cells/mL), about 20% of them harbored a pathogen (including contagious ones). Furthermore, milk fat, protein, and casein significantly declined as the differential SCC increased.

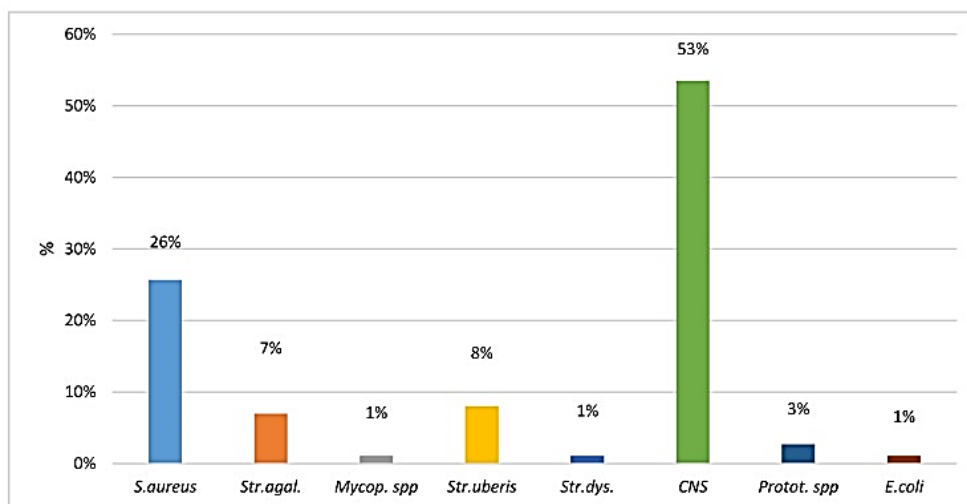


Figure 2. The proportion of bacteria species recovered by PCR from positive milk samples with $\leq 50,000$ cells/mL (Zecconi *et al.*, 2020; DOI: 10.3390/ani10040604).

It is important to note that more parameters other than the prevalence of subclinical mastitis or SCC values define udder health and milk quality. Clinical mastitis is equally an important factor. Other past studies reported increased herd levels of clinical mastitis (Elbers *et al.*, 1998; DOI: 10.3168/jds.S0022-0302(98)75592-4) or a greater proportion of clinical cases with systemic signs of illness in herds with a low bulk milk SCC (Barkema *et al.*, 1998; DOI: 10.3168/jds.S0022-0302(98)75591-2).

Another area to explore is the selection of animals with low SCC. Research results indicated that selecting animals with low SCC will not negatively affect the mammary gland's susceptibility to infection. Those lower SCC cows do not react less to infection and can also efficiently mobilize the immune system to fight infection (Rainard *et al.*, 2018; DOI:10.3168/jds.2018-14593).

Some of the basic recommendations for farmers are to consider:

- 1) **Revise individual cow reports:** you can list high SCC cows and, depending on the stage of lactation, select those that can benefit from being dried off early and treated with antibiotics at this time. Cure rates are higher during the dry period than lactation, and by doing at this time, chances are higher to retain those cows for future lactations. This also applies to heifers or first-lactation cows.
- 2) **Herd Management and protocols:** if your herd has low levels of SCC, ensure all areas within the farm are taken care of regarding hygiene and following protocols such as milking practices and bedding management. It is important to remember that the main goal is to provide an environment to keep cows comfortable and their bedding clean and dry, making it difficult for those organisms causing mastitis to **survive at the same time, increasing cows' immunity to fight if necessary.**
- 3) **Microbiological analysis:** conventional or molecular analysis is also important in milk samples with a low SCC. Remember, milk with a low SCC does not mean the herd is free of contagious pathogens problems.

Let us know if you need a specific protocol or guidance for sharing with your employees and colleagues. We will be glad to help. You may contact us at:

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