High somatic cell counts in your dairy herd: the silent problem

Somatic cell counts (SCC) are related to the total number of cells per millilitre in milk. Primarily, SCC is composed of leukocytes that are produced by the cow's immune system during an inflammatory process in the mammary gland, commonly referred to as mastitis.

Melina Bonato & Liliana Borges, R&D, ICC Brazil. www.iccbrazil.com

This inflammation results from the introduction and multiplication of pathogenic micro-organisms in the mammary gland and a complex series of events leading to reduced synthetic activity, compositional changes, and elevated SCC in milk; and the magnitude and temporal relationships of these responses vary with nutritional status, other animal factors, and the pathogen involved.

However, because the elevation of SCC is a response to an infection in the mammary gland by pro-inflammatory mediators, the major factor influencing SCC is the infection status. The effects of stage of lactation, age, season, and various stresses on SCC are minor if the gland is uninfected. Except for normal diurnal variation, few factors other than infection status have a significant impact on milk SCC. The predominant cell type present in milk, besides shedding epithelial cells, is leucocytes, which includes macrophages, polymorphonuclear neutrophils cells (PMNs), and lymphocytes. The macrophages are generally the predominant cell type in healthy cow milk. They can fight against bacterial invasion quickly by phagocytising the antigen and releasing messengers that are recognised by the PMNs (also phagocytic cells) that will be recruited in the infection site. When PMNs arrive at the site of infection, they will phagocyte micro-organisms and kill them by using a combination of oxidative and non-oxidative mechanisms.

Variations in SCC

The SCC in the milk naturally increases after calving when colostrum is produced before the cow starts the lactation, and tends to decrease until the end of lactation; however, it can vary due to many factors, including seasonal and management effects.

Essentially, a lower SCC indicates better animal health, as somatic cells originate only from inside the animal's udder.

SCC monitoring is important because as the number of somatic cells increases, milk yield is likely to fall, primarily due to the damage to milk-producing tissue in the udder caused by mastitis pathogens and the toxins they produce, particularly when epithelial cells are lost.

However, a low SCC is sometimes related to a poor immune response, but in general terms, this is not necessarily true; it may be the case that there is simply a low level of current infection.

The immune response is best measured by how quickly the immune system reacts to the disease challenge, not how many white blood cells are present before infection occurs.

The cell counts tend to reflect a response to contagious mastitis pathogens: the Bactoscan count, on the other hand, indicates the level of bacterial contamination from external sources, such as insufficient cleaning of the milking equipment or poor udder and teat preparation before milking, and can indicate a high level of environmental pathogens.

According to the European Union (EU), the udder is considered infected when the SCC is above 200,000 cells/mL, and when the SCC is above 400,000 cells/mL, the milk is not accepted for human consumption.

However, the values for milk acceptance in

Continued on page 16

Table 1. Somatic cells count in different field trials around the world ($x10^3$/mL)

Experiment	Period	Treatments		Reduction		SSC Reduction
France, 2012		Control	Yeast	Control	Yeast	
	Adaptation	98	367	99	-216	-315
	Trial	197	151			
Thailand 1, 2016	Period	Antibiotic	Yeast	Antibiotic	Yeast	SSC Reduction
	Before	1801	1537	-457	-854	-397
	After 2 months	1344	683			
Thailand 2, 2016	Period	Control	Yeast	Control	Yeast	SSC Reduction
	After 42 days	459.5	232.5		-227	-227
Chile, 2016	Period	Live Yeast	Yeast	Live Yeast	Yeast	SSC Reduction
	Before	89	75.5	+51.3	+30.2	-21.1
	After 2 months	140.3	105.7			

*Data not published

Continued from page 15
dairy industries varies in different countries. In practice, there are two methods to control mastitis in the herd: culling cows, which is a short-term solution that can quickly reduce SCC in the bulk tank; and controlling the mastitis, which is a long-term solution.

The second method is based on the following:

- Monitoring each cow monthly (with SCC records for a mastitis prevention program).
- Improving sanitation (simply keeping the udder clean and free of pathogenic bacteria that cause mastitis).
- Environmental conditions (bedding must be dry at all times; the grass sod in the pasture or dry lot should be free of mud and objects such as sticks that damage the udder).
- Special care heifer management (calves should be reared in separate pens to avoid nursing).
- The fly population must be controlled to decrease the spread of mastitis-causing bacteria.
- Springing heifers should be separated from cows.
- Dry cows treatment (the risk of intra-mammary infections is greatest during the early and late dry period when the pathogens are not flushed out on a day-to-day basis).
- Nutrition to prevent the problem (nutrition is involved in maintaining immunity, and inadequate energy or deficiencies could affect the animal resistance).

Improving immunity status

One of the strategies that could be used to improve the immunity status and consequently, to decrease the SCC, is the supplementation of Saccharomyces cerevisiae yeast as a source of metabolites and the cell wall (rich in mannan oligosaccharides [MOS] and β-glucans).

The metabolites derived from the yeast fermentation are an excellent substrate with nutrients that modulate the ruminal flora, speeding up the digestion of cellulose and hemicellulose, with benefits to bacteria and protozoa, stabilizing the ruminal pH, and increasing the production of VFAs.

The β-glucans are known as immune system modulators or stimulants. They are natural and effective stimulants of the innate immune system and when they come in contact with the phagocytic cells, which recognise the β-1,3 and 1,6 bindings, these cells are stimulated and will produce some cytokines that start a chain reaction inducing an immunomodulation and improving the response capacity of the innate immune system.

MOS, as mentioned above, are also structural components of the yeast cell wall, and are known for their pathogens (that have type 1 fimbria) agglutination capacity, such as diverse salmonella and E. coli strains. MOS offers a binding site for pathogens, preventing the colonisation of the intestinal epithelium, and these agglutinated bacteria will be excreted together with the indigestible part of the fibre.

According to Dias et al., 2017, the yeast as a source of metabolites reduced the blood haptoglobin concentration, which is an acute-phase glycoprotein produced by the liver during inflammatory processes; in this case, caused by the high level of starch in the diet.

Different field trials have shown the decrease in SCC around the world (Table 1).

Several studies have shown that the yeast as a source of metabolites could increase the milk production by +2kg/cow/day and milk quality (fat and protein), decrease SCC and diseases incidence, and also the mycotoxin contamination in the milk.

The combination of proper rumen nutrition with the strengthening of the animals' immune system means higher daily milk production, as well as reducing to zero the concerns about any residues in the milk, a key factor to conquer an increasingly demanding consumer market. ■

References are available from the authors on request