

An investigation into the validity of somatic cell count as a diagnostic tool of pathogen specific bovine intramammary infections in composite cow milk samples

This is an investigation into the validity of the somatic cell count (SCC) test as a diagnostic or survey tool to identify pathogen specific udder infections in cows when used on its own in composite cow milk samples. A SCC cut-off of 200 000 cells/ml is currently recommended by the National Mastitis Council (NMC). Sensitivity, specificity and predictive values were used to assess the validity of the 200 000 cells/ml SCC cut off to detect 19 different mastitis pathogens. This dataset contains micro-cytology results 385 594 composite cow milk samples from in most cases all lactating cows off 860 dairy herds. Cows differed in breed, parity, stage of lactation and milk yield.

Whilst over 100 different micro-organisms have been identified as causative agents of mastitis, only a few species of staphylococci, streptococci and Gram-negative organisms are of economic importance. In South Africa most cases of subclinical mastitis are caused by coagulase negative staphylococci (CNS), *Staphylococcus aureus*, *Streptococcus agalactiae* and *Streptococcus uberis*. The sensitivity of detecting mastitis pathogens at 200 000 cells/ml was low (<60%) and almost similar for all examined, indicating that SCC used at this threshold is not a good indicator of pathogen specific udder infections. Unlike sensitivity, specificity differed greatly between these pathogens. High specificities (>80%) were present when testing for *Staphylococcus aureus* (STH) (lytic group III), *Streptococcus agalactiae*, *Streptococcus dysgalactiae*, *Escherichia coli*, *Klebsiella pneumonia*, *Serratia* spp, other Gram -ve spp., *Trueperella pyogenes* and *Proteus* spp. Low specificity was shown when testing for CNS, *Staphylococcus pseudintermedius* and *Micrococcus* spp. This indicated that there was little differentiation between them and the pathogen negative milk samples.

Table 1: Sensitivity, specificity, positive predictive value and negative predictive value, all at 95% CI for bacteria comparing a SCC threshold of 200 against the culture as reference standard isolated from composite cow milk samples.

Bacteria isolated	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
Pooled	0.728 (0.726, 0.73)	0.621 (0.619, 0.623)	0.662 (0.66, 0.664)	0.692 (0.689, 0.694)
No Growth	0.555 (0.554, 0.557)	NA (NA, NA)	NA (NA, NA)	NA (NA, NA)
<i>Staph.aureus</i> (STA)*	0.563 (0.562, 0.565)	0.759 (0.750, 0.768)	0.989 (0.989, 0.990)	0.043 (0.042, 0.044)
<i>Staph.aureus</i> (STH)**	0.560 (0.559, 0.561)	0.867 (0.856, 0.877)	0.997 (0.997, 0.998)	0.021 (0.020, 0.021)
Coag. neg. staphylococci	0.583 (0.581, 0.585)	0.513 (0.510, 0.516)	0.748 (0.746, 0.750)	0.331 (0.329, 0.334)
<i>Staph. pseudintermedius</i>	0.555 (0.554, 0.557)	0.472 (0.446, 0.498)	0.996 (0.996, 0.997)	0.004 (0.004, 0.004)
<i>Micrococcus</i> spp.	0.556 (0.554, 0.557)	0.511 (0.480, 0.543)	0.998 (0.997, 0.998)	0.003 (0.003, 0.003)
<i>Streptococcus agalactiae</i>	0.561 (0.560, 0.562)	0.866 (0.856, 0.875)	0.997 (0.997, 0.997)	0.025 (0.024, 0.026)
<i>Streptococcus dysgalactiae</i>	0.559 (0.558, 0.560)	0.874 (0.862, 0.885)	0.998 (0.998, 0.998)	0.017 (0.016, 0.017)
<i>Streptococcus uberis</i>	0.564 (0.562, 0.565)	0.773 (0.765, 0.782)	0.990 (0.990, 0.991)	0.042 (0.041, 0.043)
<i>Streptococcus pyogenes</i>	0.555 (0.554, 0.557)	0.766 (0.683, 0.836)	1 (1, 1)	0.001 (0.001, 0.001)
<i>Enterococcus faecalis</i>	0.558 (0.556, 0.559)	0.768 (0.751, 0.784)	0.997 (0.997, 0.997)	0.012 (0.011, 0.012)
<i>Enterococcus canis</i>	0.555 (0.554, 0.557)	0.669 (0.592, 0.739)	1 (1, 1)	0.001 (0.001, 0.001)
<i>Escherichia coli</i>	0.556 (0.555, 0.557)	0.964 (0.942, 0.979)	1 (1, 1)	0.003 (0.002, 0.003)
<i>Klebsiella pneumonia</i> .	0.556 (0.555, 0.557)	0.966 (0.941, 0.983)	1 (1, 1)	0.002 (0.002, 0.002)
<i>Serratia</i> spp	0.556 (0.555, 0.557)	0.974 (0.948, 0.990)	1 (1, 1)	0.002 (0.001, 0.002)
Other Gram -ve spp.	0.556 (0.555, 0.558)	0.847 (0.823, 0.868)	0.999 (0.999, 0.999)	0.005 (0.005, 0.005)
<i>Trueperella pyogenes</i>	0.556 (0.554, 0.557)	0.819 (0.747, 0.877)	1 (1, 1)	0.001 (0.001, 0.001)
<i>Proteus</i> spp.	0.556 (0.555, 0.558)	0.828 (0.804, 0.850)	0.999 (0.999, 0.999)	0.005 (0.005, 0.005)
Mixed Growth	0.556 (0.555, 0.557)	0.627 (0.589, 0.664)	0.999 (0.999, 0.999)	0.002 (0.002, 0.003)
<i>Bacillus</i> spp	0.557 (0.556, 0.558)	0.657 (0.639, 0.675)	0.996 (0.995, 0.996)	0.011 (0.010, 0.011)
Contamination	0.589 (0.588, 0.590)	0.761 (0.757, 0.766)	0.959 (0.958, 0.960)	0.164 (0.162, 0.166)

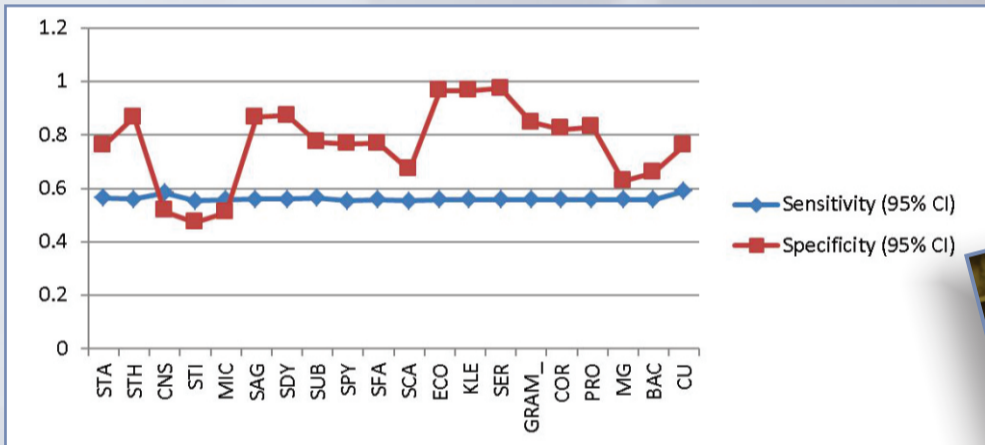


Figure 1: Comparing sensitivity and specificity when using a SCC cut-off of 200 000cells/ml to detect 19 different mastitis pathogens in composite cow milk samples.

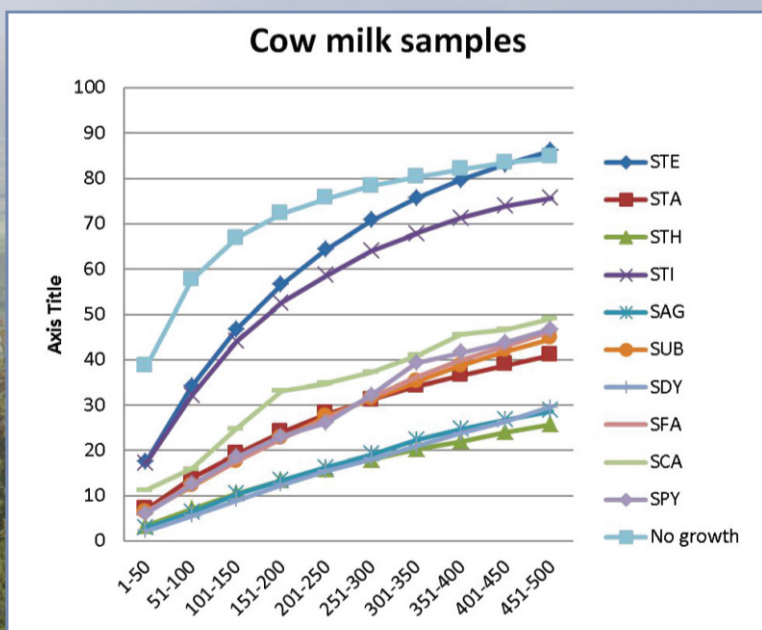


Figure 2: Cow Bact (Cum %) per SCC ranges of each bacteria group.

