Somatic cell count in dairy herds

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Dit artikel is niet door twee referenten beoordeeld en geldt dus niet als wetenschappelijk artikel.

INTRODUCTION
The dairy industry has changed considerably over the past two decades, with increased average herd size, different management styles, and new technologies. As a result, the farmer’s attention has shifted from a cow-level towards a herd-level approach, and curative treatments have been partly replaced by preventive management by means of close monitoring of herd level parameters. Guidelines to monitor udder health have been established, based on the monitoring of the Somatic Cell Count (scc). Farmers and their advisors use the scc data of individual cows (iscc) as a tool to determine whether the cow should be treated during lactation or at drying off, or should be culled. At the herd level, the Bulk Milk scc (bmscc), the proportion of cows with subclinical mastitis, or the arithmetic mean of iscc, provides information that helps farmers to take management decisions regarding udder health. The overall aim of the studies reported in this thesis was to critically review the usefulness of current scc parameters for monitoring udder health at a herd level, and, if necessary, to suggest improvements and recommendations for the use of these parameters.

STUDIES AND RESULTS
To examine if current herd level parameters are useful tools in udder health management, the first study of this thesis assessed whether the bmscc reflects the average scc of all individual lactating cows, by comparing the bmscc with the average herd scc corrected for milk yield (chscc) on 246 farms. After the difference was corrected for the sampling variation in bmscc, which ranged from 1,800 to 19,800 cells/mL, on average the bmscc was 49,000 cells/mL lower than the chscc. The difference ranged from -10,000 to 182,000 cells/mL, and increased with increasing bmscc. Management practices associated with farms with a small (<20%) or large (≥ 20%) difference between bmscc and chscc were investigated. Farms in which the bmscc–chscc difference was small administered intramuscular antibiotics more often for the treatment of clinical mastitis, more frequently used a high scc history to choose the correct antibiotic when cows were dried off, and had a higher number of treatments per clinical mastitis case than farms with a large (≥ 20%) difference. Farms feeding high scc milk or milk with antibiotic residues to calves were 2.4 times more likely to have a large difference between the two parameters. The bmscc, in addition to reflecting the average scc in a herd, is often also seen as a herd-level parameter correlated with the prevalence of subclinical mastitis. A subsequent study investigated whether there was a correlation between bmscc and the prevalence of subclinical mastitis. The study also investigated whether chscc and the arithmetic average test-day scc (hscc) of the lactating herd were associated with the prevalence of subclinical mastitis. The correlation between the prevalence of subclinical mastitis and bmscc, chscc, and hscc, was 0.64, 0.78, and 0.89, respectively.

Although these two studies showed that the bmscc is not a good approximation of the actual average herd scc or the prevalence of subclinical mastitis, it is apparent that, for a large number of farms worldwide, bmscc is the scc parameter available to monitor trends in udder health. The frequency of sampling of the bmscc varies considerably between countries, and it is not known to what extent the sampling interval or variation in bmscc data influences the accuracy of measurements. A subsequent study investigated the influence of sampling interval and variation in bmscc data on the accuracy of bmscc measurements. Because bmscc is measured at regular intervals, an Artificial Neural Network was used to determine both the effect of sampling interval and variation in the bmscc data. The intervals examined in this study ranged from 4 to 14 days and were compared to the baseline of a standard 2-day sampling interval on two subsets of farms, with a low (n=239) and a high (n=236) standard deviation (sd) of bmscc data. Only sampling interval did have a significant effect on the accuracy of bmscc measurements. On average, the error of the Artificial Neural Network model was 32,000 cells/mL for all farms included, ranging from 15,000 cells/mL (4-d interval) to 41,000 cells/mL for the 14-day sampling interval. Therefore, the length of the sampling interval greatly influences the usefulness of bmscc for monitoring trends in udder health.

On the basis of the results of the first two studies, it was concluded that hscc was the preferred parameter with the highest accuracy for on-farm situations regarding udder health at a herd level. Subsequently, this parameter was used in the...
next two studies to quantify which variables contribute to the \(\text{hSSC} \) itself and whether it is possible to predict the subsequent \(\text{hSSC} \). While the monitoring and interpretation of \(\text{scc} \) parameters such as the \(\text{hSSC} \) is essential, little is known about the precise quantitative contribution of relevant variables and the possible difference in these quantitative effects at different levels of \(\text{hSSC} \). In a study involving 246 farms, the contribution of management practices, herd characteristics, and seasonal variables on the \(\text{hSSC} \) was quantified in herds with low (<150,000 cells/mL), medium (150,000–200,000 cells/mL), and high (>200,000 cells/mL) average \(\text{hSSC} \), by means of a Linear Mixed Effect (LME) model. Management practices were not associated with \(\text{hSSC} \) in all three categories. Some variables had only a significant association with \(\text{hSSC} \) in one category, such as dry premilking treatment (~9,100 cells/mL in the low \(\text{hSSC} \) category) or feeding calves with high \(\text{scc} \) (11,100 cells/mL in the medium \(\text{hSSC} \) category). Others had an opposite effect on \(\text{hSSC} \) in different categories, such as average parity (~6,400 and 11,000 cells/mL in the low and medium \(\text{hSSC} \) category, respectively) and feeding calves with fresh milk (10,300 and ~9,700 cells/mL in the low and high \(\text{hSSC} \) category, respectively).

Historical \(\text{scc} \) data are used to monitor udder health at a herd level, but these data could be out of date when a decision about udder health is taken. The ability to predict the average \(\text{hSSC} \) of the next month would support udder health management decisions. This possibility was examined using the data on \(\text{scc} \), herd characteristics, season, and management practices determined in the previous study. The LME model was tested on a new dataset of 101 farms. The final LME model predicted 72% and 81% of the \(\text{hSSC} \) of the next month correctly within the predetermined range of 20,000 and 30,000/mL, respectively. These outcomes indicate that the final LME model is a valid additional tool for farmers that could be used to support their short-term decisions regarding udder health management and could be included in dairy herd health programmes.

As many risk factors have been found to be associated with subclinical mastitis in studies from the United States and Europe, a final study was performed to examine whether these factors would also be valid for Australian dairy farms. In total 126 dairy farms from New South Wales responded to a survey to gather information on relevant risk factors associated with subclinical mastitis. Two groups of farms were compared, a group with low (~20%) and a group with a high (≥20%) prevalence of subclinical mastitis. Results of the multivariate analysis of management practices indicated that wearing gloves during milking (odds ratio = 0.24), using paper towels for udder preparation (odds ratio = 0.20), and feeding cows directly after milking (or = 0.14) were associated with a lower prevalence of subclinical mastitis (~20%). Using selective dry cow treatment (odds ratio = 4.0) and recording treatments for a high \(\text{scc} \) (odds ratio = 5.9) were associated with a higher (~30%) prevalence of subclinical mastitis. The prevalence of subclinical mastitis in this cross-sectional study was comparable or lower than that reported in studies from North America and Europe, and management practices had a similar effect on udder health in Australia.

**CONCLUSIONS**

Briefly stated, the main conclusions of the studies described in this thesis are:

- \(\text{bmscc} \) is less useful as tool to monitor udder health when individual herd recording data are available.
- The difference between \(\text{bmscc} \) and the average \(\text{scc} \) of all lactating cows is significant up to 40%.
- If \(\text{bmscc} \) data are the only data available to monitor udder health at a herd level, it is likely that the prevalence of subclinical mastitis will be underestimated.
- When \(\text{bmscc} \) data are used to detect a trend in average \(\text{hSSC} \), the error in describing a series of \(\text{bmscc} \) data increases significantly when the sampling interval exceeds 4 days.
- When \(\text{bmscc} \) are used as the outcome variable in management studies, a proportion of farms may be inaccurately classified as having a low risk of subclinical mastitis and, as a consequence, the association between \(\text{bmscc} \) and certain management practices would be incorrect.
- The contribution of management, herd characteristics, and seasonal variables is different per level of average \(\text{hSSC} \), and therefore management advice should take the average \(\text{hSSC} \) into account.
- Management style might be as important as implementation in the impact that a management practice has.
- An accurate prediction of the average \(\text{hSSC} \) for the subsequent month is possible if information on management, herd characteristics, and seasonal variation is taken into account.
- Management practices applied in the \(\text{EU} \) and United States have a similar effect on udder health in Australia.

**REFERENCES**