Development of bulk milk quality from herds with automatic milking systems

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Summary

The objective of this paper was to analyse the changes in milk quality of AMS farms from the introduction in 1998 until the end of 2004. AMS companies reported the starting date of each new farm to the Danish Dairy Board and this information was merged with the bulk milk quality of each delivery. Bulk milk cell counts were higher on AMS farms in the first year, which led to the introduction of the Danish self-monitoring program. From that time bulk milk cell counts dropped until 2001, but then increased to slightly above the average of all Danish herds. It is not known if the increase in cell count can be ascribed to management or if AMS in general have a negative influence on the udder health. Total bacterial count is still higher than the average of all Danish herds, but has improved significantly over the years. A parallel trend was seen in spores of anaerobes. There were major problems with high freezing points in bulk milk during the first years with AMS, but these problems have now been solved. Overall quality of bulk milk from AMS herds has improved considerably over the years and the fact that some companies have reached the quality standard of all Danish herds makes us believe that general milk quality problems of AMS herds will disappear in the near future.

Key words: *Automatic milking systems, milk quality, cell count, bacterial count, freezing point*

Introduction

Automatic milking systems (AMS) were introduced on commercial farms in Holland in 1992 and the first AMS came to Denmark in January 1998. AMS were well received in Denmark and the number of farms investing in AMS has been high since then. By the end of 2004, Denmark has close to 400 farms with AMS (Figure 1). In relation to a total of 6600 dairy farms, this corresponds to more than 6% which is the highest proportion of AMS in the World. The milk quality of Danish AMS farms did not reach the same average quality as that of all Danish herds during the introductory years (Rasmussen et al., 2002) and especially the bulk milk SCC was higher than in conventional herds, even compared with Dutch

figures (Klungel et al., 2000). The objective of the present paper was to analyse the development in the milk quality during the years with AMS in Denmark.

Material and methods

The Danish distributors of AMS report the starting date of every new AMS farm to the Danish Dairy Board. Milk quality data of every delivery to the dairy factories were merged with the starting dates. Data were included as long as the AMS farms were delivering milk and 22 farms either stopped having dairy cows or invested in another milking system during the 7 years. Samples were analysed for somatic cell count (SCC) and total bacterial count once every week, freezing point once every four weeks, and spores of anaerobes once every four weeks from October to March. Averages of all Danish farms were included in the dataset to produce the figures and calculate differences to individual samples. SCC, TBC, and spores of anaerobes were log-transformed before statistical calculations to account for non-normal distributions. The procedure PROC MIXED (SAS, 1999) was used to test absolute values and differences from Danish averages. The statistical model included fixed effects of AMS model, year, month and the interaction between year and model. Herd number was included as the random variable and sampling date within herd was used as the repeated subject. Results are presented as LSMeans.

Cell count

The cell count of bulk milk was higher on AMS farms during 1998 and 1999 until the self-monitoring program was in place (Figure 2). Bulk milk SCC came very close to the average of all Danish herds in the year 2000 when only the peak seen during the summer months was higher than the average of all herds. Since then, the differences between the average of all herds and the average of AMS herds have increased steadily (Table 1), which mainly seems to be explained by a general drop in SCC of all Danish herds compared with AMS herds having a minor tendency to drop. Although the Danish self-monitoring program had good success in lowering the bulk milk SCC in its first years (Rasmussen et al., 2002), AMS herds have not reached the same SCC as other Danish herds. We can only speculate why this is so, but further statistical analysis did not reveal causation with starting year, which could have explained differences due to the efficiency of the Danish self-monitoring program or the technical mechanisms of the AMS in appointing cows with abnormal milk. Earlier studies have shown that the number of new infections in AMS herds increases during the first year of operation (Rasmussen et al., 2001) and the trend in AMS herds not to follow the country's average could indicate that udder health may be poorer in AMS herds than in conventional herds. If this is true, work is needed to explore and improve this to make AMS competitive compared to conventional milking.

Total bacterial count

Bulk milk total bacterial count was about doubled in milk from AMS herds during 1998, but has since declined steadily (Figure 3 and Table 1). The number of samples exceeding 30,000 cfu/ml has dropped from 21% in 1998 to 9% in 2004. A small increase was seen from 2003 to 2004 in both AMS and all herds. The geometric mean of AMS herds was 12,000 cfu/ml in 2004 compared with 7,000 cfu/ml of all herds. Although the quality in terms of total bacterial count has improved considerably since the introduction of the first AMS, there is still room for improvement compared to the high standard of Danish herds. We do not have conclusive material on the causes of the higher bacterial counts, but cleaning, cooling and hygiene may all play a role.

Anaerobic spores

Anaerobic spores in bulk milk are an indicator of contamination with manure and as such of insufficient cleaning of teats before attachment of the teatcups. The anaerobic spores originate from poor quality silage, and perhaps farms with AMS do a poorer job in this respect, but this is not very likely. We probably have to ascribe a higher spore count in bulk milk of AMS herds to a poorer hygiene, including more cows with dirty teats and insufficient cleaning at time of milking. However, the number of anaerobic spores in milk from AMS herds have decreased steadily since 1998 and is coming close to the average of all Danish herds in 2004 (Table 1). There are differences between the AMS models on the market, and only one model has been able to keep the level of all herds in Denmark for all the years on the market whereas others have been significantly higher than the average of the country. The percentage of samples not reaching first class (400 spores/L) has dropped from >50% in the first years with AMS to 18% in 2004. This is a very positive trend indicating that management has improved over the years.

Freezing point

A high freezing point in bulk milk was a major problem during the first years with AMS, but by the good efforts of the companies the freezing point hass now been brought very close to the average of all Danish herds (Figure 4). The average for AMS herds was –0.524° C in 2004 whereas the national average was –0.525° C. The frequency of freezing points above –0.516° C was 23% in the first year with AMS, declining to 2.2% in 2004. Problems with high freezing points could mainly be ascribed to technical details, which has obviously been solved by now.

Conclusions

There were major problems with the milk quality of AMS herds during the first years in Denmark. Since then, the overall quality of bulk milk from AMS herds has improved considerably. This applies especially for freezing point, but also for spores of anaerobes and total bacterial count. Bulk milk cell count dropped during the first years with AMS, but has increased to slightly above the average of all Danish herds since then. It is not known if the increase in cell count can be ascribed to management or if AMS in general has a negative influence on the udder health.

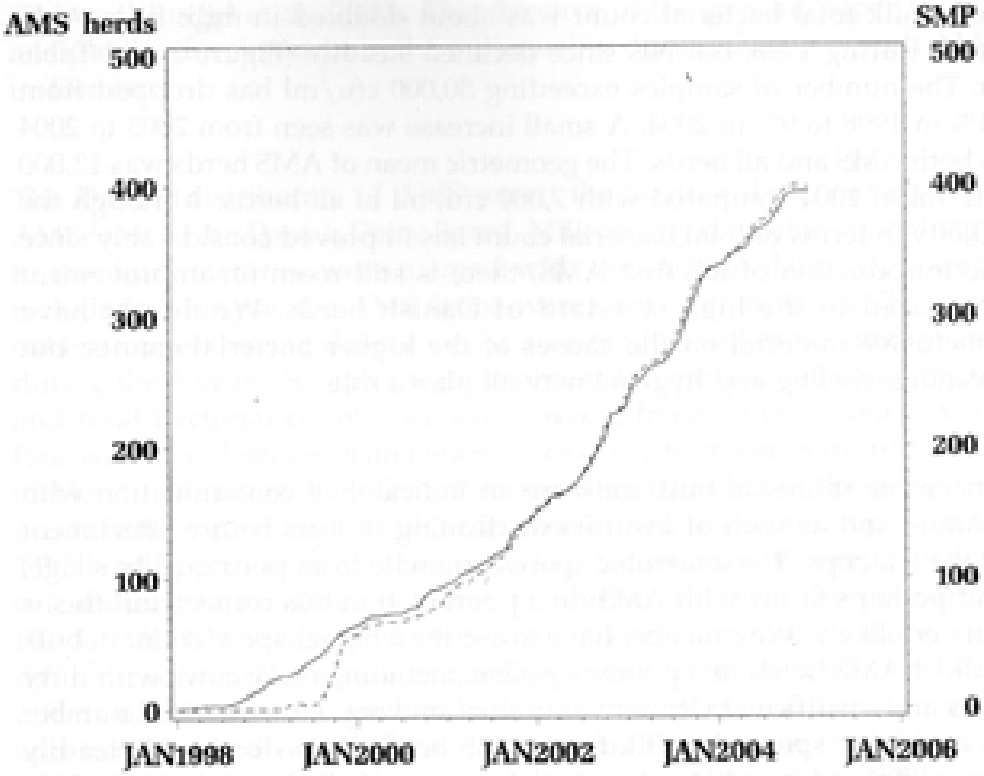

Figure 1. Number of AMS farms in Denmark (solid line) and farms included in the self-monitoring program (dashed line).

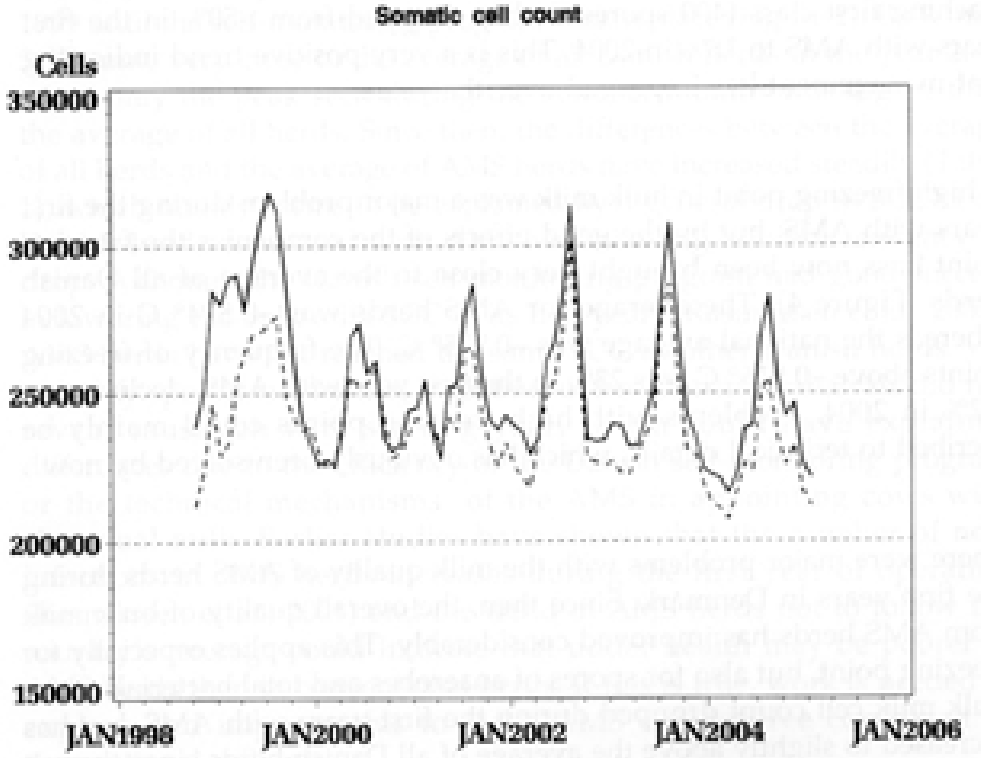

Figure 2. Bulk milk cell count of herds with AMS (solid line) and the average for all Danish herds (dashed line).

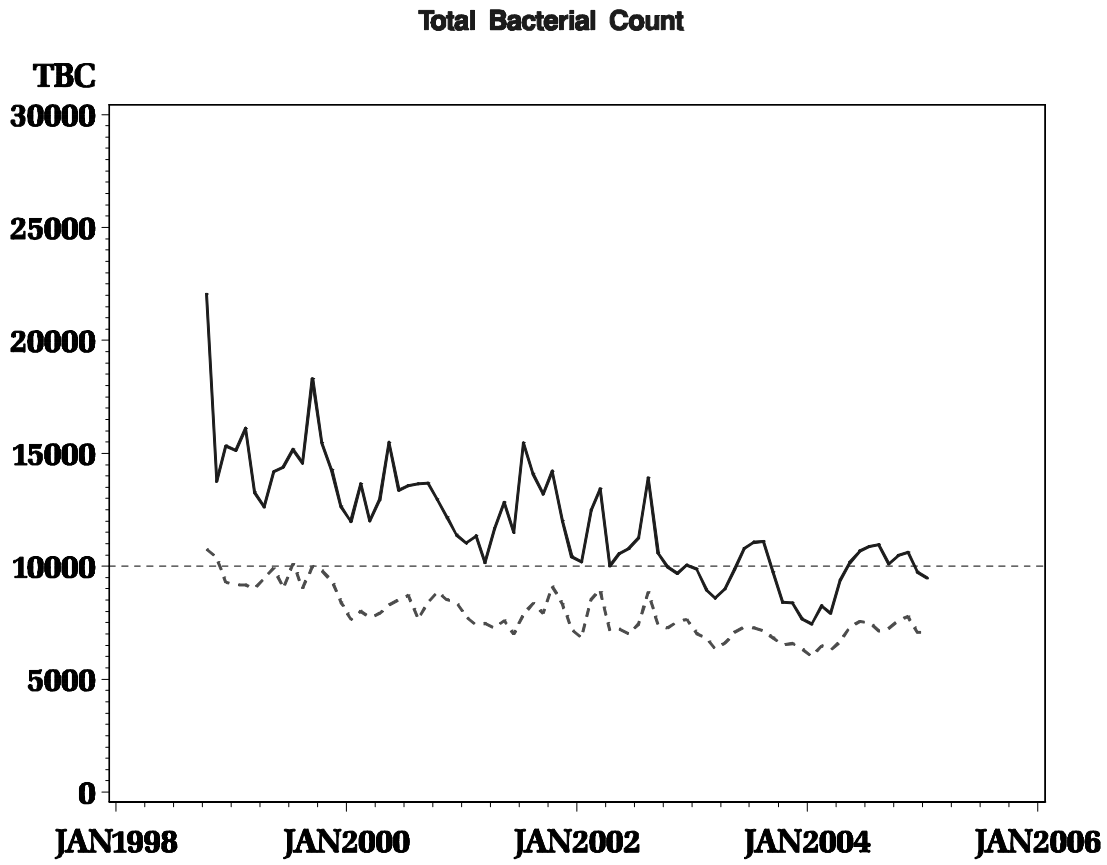

Figure 3. Bulk milk total bacterial count of herds with AMS (solid line) and the average for all Danish herds (dashed line).

Table 1. Development in the bulk milk quality of Danish AMS herds (log values) and the difference (dif) between AMS and the average of all Danish herds.

Year	Log cells	Dif cells	Log Bact	Dif Bact	Log Spores	Dif Spores
1998	5.47 [d]	0.129 [f]	4.27 [f]	0.28 [c]	2.99 [e]	0.53 [e]
1999	5.48 [d]	0.079 [e]	4.24 [f]	0.28 [c]	2.93 [e]	0.28 [de]
2000	5.41 [a]	0.036 [a]	4.17 [e]	0.26 [bc]	2.67 [d]	0.20 [bc]
2001	5.42 [b]	0.043 [b]	4.16 [d]	0.27 [c]	2.38 [c]	0.22 [cd]
2002	5.43 [c]	0.048 [c]	4.13 [c]	0.25 [b]	2.36 [c]	0.21 [bc]
2003	5.43 [c]	0.050 [c]	4.07 [a]	0.23 [a]	2.19 [b]	0.19 [b]
2004	5.41 [a]	0.056 [d]	4.08 [b]	0.23 [a]	2.12 [a]	0.12 [a]

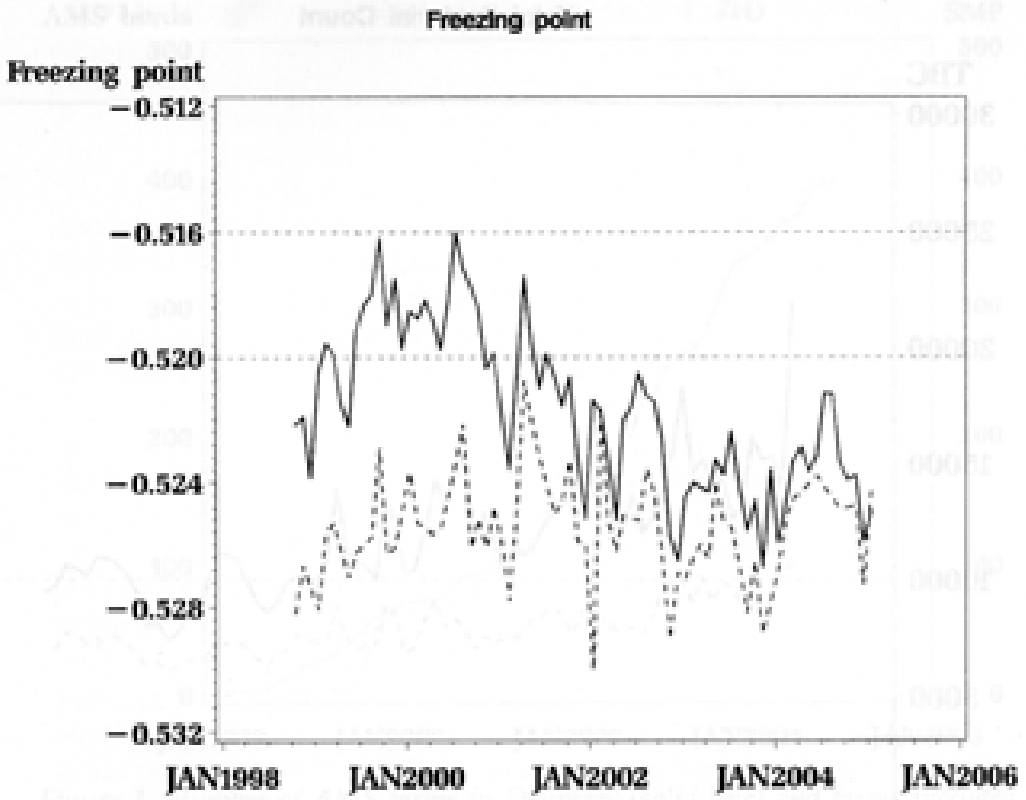

Figure 4. Freezing point of bulk milk from herds with AMS (solid line) and the average for all Danish herds (dashed line).

References

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