Staphylococcus aureus and Streptococcus agalactiae in Milk and Teat Skin from Cows in Automatic Milking Systems

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Introduction

Staphylococcus aureus and Streptococcus agalactiae are traditionally considered contagious mastitis pathogens transmitted from cow to cow during milking. S. aureus has been isolated from teat skin and teat skin colonization has been associated with an increased risk of intramammary infection (IMI) (Da Costa et al. 2014). Recently S. agalactiae has been isolated from extramammary body sides as well as the environment of dairy herds (Farre et al. 2017; Jorgensen et al. 2016). However, the role of the teat skin as a reservoir of S. agalactiae is unknown, and the role of S. aureus is still discussed and not yet investigated in automatic milking systems (AMS) with more milkings per day, individual cleaning of teats and less human contact. The aim of this study was to investigate the association between teat skin colonization and IMI with S. aureus or S. agalactiae in AMS herds.

Materials and Methods

In eight Danish S. agalactiae positive AMS herds (bulk tank milk test): we randomly selected 300 lactating cows (30-40 from each herd) with somatic cell count ≥ 200,000 cells/mL at last milk recording (5-33 days before sampling). At herd visits in the spring of 2017 teat skin and milk samples were collected at quarter level from the selected cows. Teat skin swab samples were collected using the wet-dry method (Paduch and Krömker 2011) and aseptic foremilk samples were collected following NMC guidelines. Samples were kept at 5°C overnight until laboratory analysis the next day. All samples were cultured on blood agar, Modified Edward’s medium and a selective medium for S. aureus (SA SELECT™). Teat skin samples were vortexed and 0.1 mL was inoculated to a whole agar plate. Milk samples were vortexed and 0.01 mL was streaked on a quarter of an agar plate. Plates were incubated aerobically at 37°C for 48 h. Identification was based on morphology and all suspected colony-types were verified using MALDI-TOF (S. aureus) or Latex agglutination test (S. agalactiae). A quarter was considered positive (milk or teat skin) if ≥ 1 colony of S. aureus or S. agalactiae was detected on at least one of the three media used per sample.

Results and Discussion

Milk and teat skin samples were cultured from 1142 quarters (300 cows). S. aureus (table 1) was detected in 8.1% (n = 93) of the milk samples and 6.6% (n = 75) of the teat skin samples. Of these, 15 (1.3%) quarters were positive in both teat skin and milk samples. S. agalactiae was detected in 7.4% (n = 84) of the milk samples and 0.35% (n = 4) of the teat skin samples. Of these, three (0.26%) quarters were positive in both teat skin and milk samples. To the best of our knowledge this is the first report on isolation of S. agalactiae from teat skin. However, the three quarters from which S. agalactiae was isolated in both teat skin and milk
samples were from the same cow. The only quarter that was teat skin positive and milk negative was from a cow where *S. agalactiae* was isolated from milk in two other quarters. Based on these results it appears that teat skin colonization with *S. agalactiae* is very rare (in AMS); even in cows with high somatic cell count in herds with *S. agalactiae* history. There were 3.2 higher odds of a quarter being milk positive and teat skin positive, relative to being teat skin negative and milk positive (P = 0.0002). Also, our preliminary multivariate (log-linear) analysis indicates that the occurrence of *S. aureus* on teat skin and in milk is related to herd and teat-end hyperkeratosis scores.

A limitation of this study is that we do not know if the same strain type is present on teat skin and in milk of the same quarter. Repeated sampling from the same quarters would be useful to investigate the dynamics and cause-effect relations of *S. aureus* occurrence.

### Table 1: A crude estimate of the interrelation between occurrence of *Staphylococcus aureus* on teat skin and in quarter milk samples

<table>
<thead>
<tr>
<th>Staph. aureus</th>
<th>Milk positive, n quarters</th>
<th>Milk negative, n quarters</th>
<th>Total, n quarters</th>
<th>Odds Ratio (milk positive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teat positive, n quarters (%)</td>
<td>15 (20 %)</td>
<td>60 (80 %)</td>
<td>75 (100 %)</td>
<td>3.2*** [1.7; 5.8]</td>
</tr>
<tr>
<td>Teat negative, n quarters (%)</td>
<td>78 (7 %)</td>
<td>989 (93 %)</td>
<td>1067 (100 %)</td>
<td>1.0</td>
</tr>
<tr>
<td>Total, n quarters</td>
<td>93</td>
<td>1049</td>
<td>1142</td>
<td>*** P = 0.0002</td>
</tr>
</tbody>
</table>

### Conclusions

*S. agalactiae* can be isolated from the teat skin of cows with *S. agalactiae* IMI, but it appears to be very uncommon even in high-risk herds and cows. For *S. aureus* there is considerable evidence of interrelation between teat skin colonization and IMI.

### Acknowledgement

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### References


