Coagulase negative staphylococci distribution in dairy herds with automatic milking system and their crosstalk with Staphylococcus aureus from IMI and teat apex

Mahmmod, Y.; Klaas, I.; Svennesen, L.; Pedersen, Karl; Ingmer, H.

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Coagulase Negative Staphyloococci Distribution in Dairy Herds with Automatic Milking System and their Crosstalk with Staphylococcus Aureus from IMI and Teat Apex

Mahmmod Y1, Klaas I1,2, Svennesen L1, Pedersen K3, Ingmer H1
1 University of Copenhagen, Frederiksborg C, Denmark
2 DeLaval International AB, Tumba, Sweden (present)
3 Technical University of Denmark, Kongens Lyngby, Denmark

yasser@sund.ku.dk

Table 1. Species distribution and association of CNS isolates from aseptic quarter milk and teat skin samples collected from 142 cows

<table>
<thead>
<tr>
<th>CNS species</th>
<th>Sample type (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Milk (n=105)</td>
<td>Teat (n=268)</td>
</tr>
<tr>
<td>S. arlettae (12)</td>
<td>1 (0.9)</td>
<td>11 (4.1)</td>
</tr>
<tr>
<td>S. capitis (3)</td>
<td>---</td>
<td>3 (1.1)</td>
</tr>
<tr>
<td>S. chromogenes (16)</td>
<td>11 (10.5)</td>
<td>5 (1.9)</td>
</tr>
<tr>
<td>S. cohnii (43)</td>
<td>5 (4.8)</td>
<td>38 (14.2)</td>
</tr>
<tr>
<td>S. epidermidis (60)</td>
<td>52 (49.5)</td>
<td>8 (3.0)</td>
</tr>
<tr>
<td>S. equorum (122)</td>
<td>6 (5.7)</td>
<td>116 (43.3)</td>
</tr>
<tr>
<td>S. haemolyticus (58)</td>
<td>16 (15.2)</td>
<td>42 (15.7)</td>
</tr>
<tr>
<td>S. hominis (17)</td>
<td>3 (2.9)</td>
<td>14 (5.2)</td>
</tr>
<tr>
<td>S. piscifermentans (2)</td>
<td>---</td>
<td>2 (0.8)</td>
</tr>
<tr>
<td>S. saprophyticus (5)</td>
<td>---</td>
<td>5 (1.9)</td>
</tr>
<tr>
<td>S. sciuri (9)</td>
<td>---</td>
<td>9 (3.4)</td>
</tr>
<tr>
<td>S. simulans (2)</td>
<td>2 (1.9)</td>
<td>---</td>
</tr>
<tr>
<td>S. sucicnus (2)</td>
<td>---</td>
<td>2 (0.8)</td>
</tr>
<tr>
<td>S. vitulinus (1)</td>
<td>---</td>
<td>1 (0.4)</td>
</tr>
<tr>
<td>S. warneri (2)</td>
<td>1 (0.9)</td>
<td>1 (0.4)</td>
</tr>
<tr>
<td>S. xylosus (19)</td>
<td>8 (7.6)</td>
<td>11 (4.1)</td>
</tr>
</tbody>
</table>

CONCLUSIONS

- S. epidermidis and S. chromogenes are milk-associated, while S. equorum and S. cohnii are teat-associated.
- CNS species, habitat type, and herd factors affect CNS and S. aureus crosstalk patterns.
- Downregulation of S. aureus by some CNS species could explain possible protective effect.

This research study was supported by the Danish Milk Levy Foundation

METHODOLOGY

- **Herd selection:** 8 herds: AMS with ≥3 milking robots and bulk tank PCR Ct-values ≤32 for S. agalactiae
- **Cows selection:** 30-40 cows/herd: SCC ≥ 200,000 cells/mL, and no antibiotic ≤ 4 weeks prior to sampling
- **Quarter selection:** RH & LF quarters of cows with odd lab number (1,3,5,..)
- Teat skin swabs (modified wet-dry method) and aseptic milk samples collected for bacterial culture using calf blood agar and SA SELECT™
- Suspicious CNS colonies were subjected to MALDI-TOF assay for species identification.
- Interaction between S. aureus and CNS investigated with Qualitative Beta-Galactosidase Reporter Plate Assay based on 3 reporter strains of S. aureus; hla (a-hemolysin), RNAIII (key effector molecule of agr) and spa (Protein A).

RESULTS

- 80% (228/284) quarters (142 cows) had ≥ 1 CNS species.
- 373 isolates, milk (n=105) and teat skin (n=268).
- 16 CNS species: teat skin (n=15), milk (n=10)
- Coinfections (mixed): 11 quarters from milk samples and 66 quarters from teat samples.
- Downregulation of S. aureus by some CNS may be explained by its ability to inhibit S. aureus agr system through production of auto-inducing peptide (AIP) molecules.
- Table 1 shows CNS species distribution and Figure 1 shows crosstalk between S. aureus and CNS.

Figure 1. Crosstalk patterns between S. aureus and CNS

**Downregulation effect**
- 62, 65: S. arlettae (teat, H7)
- 61: S. chromogenes (teat, H7)
- 5: S. chromogenes (milk, H3)

**Variant effect**
- 1: S. equorum (milk, H1)
- 2: S. equorum (milk, H2)
- 6: S. epidermidis (milk, H3)
- 58: S. epidermidis (teat, H7)

**No effect**
- 66: S. Sciuri (teat, H7)
- 7: S. Sciuri (teat, H3)

BACKGROUND

- Longer milking duration and frequent exposure to teat disinfectants may affect the teat apex microbiota.
- Knowledge of epidemiological characteristics of CNS in automatic milking systems (AMS) herds is sparse.
- The role of CNS on the risk to acquire of IMI with S. aureus is debated.

OBJECTIVES

1) To investigate the distribution of CNS species from aseptically collected quarter milk samples and teat skin in AMS herds.
2) To examine if the isolated CNS influence the expression of S. aureus virulence factors controlled by the agr quorum sensing system.