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The influence of iodine teat dipping and an external teat sealant in heifers on bacterial isolation from quarter milk culture obtained post-calving

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Abstract

A longitudinal observational 2 year field study including 178 dairy herds was conducted in Norway. The aim of the study was to investigate the influence of iodine post milking teat dipping (PMTD) and an external teat sealant (ETS) in first calvers (heifers) on bacterial isolation from milk culture post-calving. Every heifer was either sampled in connection with a clinical mastitis (CM) event at calving or otherwise approximately 6 days post-calving. Milk culture results were available from 3218 individual heifers and 12,872 quarter milk samples. Separate multivariable logistic regression models were used for each bacterium. Neither use of PMTD nor ETS did decrease the risk of bacterial isolation post-calving. However, if iodine PMTD had been used, there was an increased risk of clinical mastitis (Odd ratio (OR)=1.6 (0.9–2.7)) and an increased risk of isolation of coagulase negative staphylococci OR=1.5 (1.0–2.1). If ETS had been used, there was an increased risk of isolation of coliform bacteria (coliform and *Escherichia coli*) (OR=2.9 (1.2–7.3)). There was significantly less *Streptococcus dysgalactiae* during the summer and autumn compared to the winter and spring. There was a significant herd effect for *Streptococcus uberis* and for coliforms with an OR=5.1 (2.1–12) and 4.5 (2.7–7.6) respectively.

Keywords: Iodine teat dipping; External teat sealant; Heifers; Bacterial isolation post-calving

1. Introduction

Intramammary infection and clinical mastitis (CM) in first calvers (heifers) in early lactation result in long-term production loss (Oliver et al., 2003; De Vliegher et al., 2005a), an increased risk of CM in the subsequent lactation and an increased risk of removal from the herd (Waage et al., 2001; De Vliegher et al., 2005b).

Teat dipping is assessed as one of the most important investments applied in prevention of bovine mastitis, and is an essential part of the five point plan (Kingwill et al., 1970). Not all types of intramammary infections are reduced equally by germicidal teat dips (Natzke, 1977; Farnsworth et al., 1980). Infections by contagious bacteria, those spread primarily from quarter to quarter and from cow to cow during milking, are reduced

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markedly by germicidal teat dips. However, pathogens frequently contracted from the cow's environment are controlled less effectively by teat dipping. Application of a teat sealant is an alternative to germicidal teat dipping (Pankey, 1984) and post milking use of an acrylic latex teat dip without germicide has proved effective in reducing coliform infections by 76% (Farnsworth et al., 1980).

Teat dipping is only recommended in Norway after a thoroughly examination of the most common mastitis pathogens in the herds. An old survey from 1994 to 1995 revealed that 12% of the farmers applied a teat dipping routine, and a national survey conducted in 2000 discovered *Staphylococcus aureus* isolation from 22.2% of the dairy cows and *S. aureus* was the most prevalent bacterium isolated in first parity cows (Østerås et al., 2006). It was thus of interest to see if routinely application of an iodine postmilking teat dipping (PMTD) or an external teat sealant (ETS) would have an impact the bacterial flora in general and thus reduce the occurrence of *S. aureus*.

The objective of this paper was to investigate associations between use of iodine PMTD or an ETS and bacterial isolation from quarter milk samples drawn from fresh heifers.

2. Materials and methods

2.1. Selection of the herds and sampling procedure

A longitudinal 2-year field study was designed which originally included 215 dairy herds. The herds were randomized into a combined selective dry cow therapy and teat dipping trial as a computerised systematic random assignment. The inclusion criteria were: 1) herds had to be members of the Norwegian Dairy Herd Recording System (NDHRS), 2) the farmer was willing to use the selective antibiotic treatment and teat dipping regime he/she was given according to a random selection process, 3) the farmer had to deliver milk to TINE BA (The Norwegian Dairies) during the study period, 4) the farmer had cow milk somatic cell count (CMSCC) test-day samples taken monthly during the study period, and 5) the farmer had to implement the Nordic recommendations concerning milking routine described by Alfnes and Østerås (1992).

The exclusion criteria were: 1) the farmer withdrew from the study because he/she did not follow the protocol, 2) the farmer withdrew from the study if the local veterinarian suspected that the protocol was not being followed, or if 50% or more of the quarter milk samples were forgotten, and 3) herds were withdrawn if co-ownerships were dissolved during the study period. The data have been further described in detail by Whist et al. (2007).

Every heifer was either sampled in connection with a CM event at calving or approximately 6 days post-calving. Single milk samples were used. CM was classified as severe/modarate or mild according to the International Dairy Federation (1999). CM recorded in the Norwegian Cattle Health Recording System are all veterinary treated cases. More detailed description of these data sampling procedure is described by Østerås et al. (2007). The analyses were conducted at quarter level. A quarter was classified as either a *S. aureus,* a *Streptococcus dysgalactiae*, *Echerichia coli*, coliforms, coagulase negative staphylococci (CNS), *Streptococcus uberis* quarter or a culture-negative quarter (denoted 1 for each of the variable defining these bacterial classes) all other quarters were denoted 0 for the same bacterial finding. A quarter with a mixed *S. aureus* and *S. dysgalactiae* infection were included in both models as a positive *S. aureus* or *S. dysgalactiae* quarter respectively.

The clinical affected quarters were characterized as having clinical symptoms, clinical signs or visible inflammatory changes in the milk or not (1, 0) according to information given by the farmers, veterinarians or the laboratory personal.

2.2. Bacteriological examination of quarter milk samples

Veterinarians collected the first milk samples and taught the farmers aseptic milk sampling technique. The farmers then collected the other milk samples throughout the trial. Milk samples were taken according to the Norwegian standard procedure; teat ends were cleaned with warm water and dried before 10 to 15 mL of milk was drawn and discarded. The teat ends were then scrubbed with a cotton or paper towel containing 70% ethanol; one towel was used for each teat before the sample was collected. Samples were cooled in a refrigerator as soon as possible, at least within a few hours, after sampling and kept cool until submission by mail to the TINE Norwegian Dairies Mastitis Laboratory, Molde, Norway. Samples taken before or during the weekend were frozen to avoid overgrowth.

The samples were analyzed for bacterial growth on blood agar plate (Blood Agar Base, Oxoid Ltd, Hampshire, UK) mixed with 5% washed bovine erythrocytes. The examination of bacterial growth and diagnostics followed the official Norwegian procedure (National Veterinary Institute, 1993), and in agreement with the recommendations of the International Dairy Federation (International Dairy Federation, 1981). The plates were divided into quarters using a ß-hemolytic *S. aureus* streak. The amount of 0.01 mL quarter foremilk was streaked out on each quarter before incubation at 37 °C ± 1 °C for 18–24 h. The samples were diagnosed as contaminated if there was rich growth of more than 2 different types of colonies. If more than 2 quarters were classified as contaminated the cow was advised to be resampled by the farmer. Typical colonies for *Staphylococcus spp.* producing a typical β-haemotoxic zone was classified as *S. aureus.* Combined growth of *S. aureus* and *S. dysgalactiae* was classified separately. Other colonies of *Staphylococcus spp.* were classified as coagulase positive or negative using Prolex ™ Staph Latex Kit (PRO-LAB Diagnostics, Toronto, Canada). Coagulase positive isolates were diagnosed as *S. aureus. S dysgalactiae* and *S. uberis* were classified based on colony