DAIRY VETERINARY NEWSLETTER

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During Cold Weather with Risk of Frostbite, How Effective is Powdered Teat Dip?

Having lived in the Intermountain West for over 15 years, in the Northeast for 16 years before that, and lived and practiced in the Upper Midwest before that, I find it interesting how many people who have primarily lived and worked in one of those areas assume that numerous aspects of dairy farming and management practices are markedly different between them. There are indeed some climate differences - some of which are growing worse in different ways in different parts of the country - between them. However, especially in northern and central Utah and southern Idaho, the differences in all aspects of dairy farming from other northern areas of the U.S. - except for irrigation - are not nearly as great as I sometimes hear people state they are. One issue that many parts of the temperate U.S. face when milking dairy cattle is what to do when cold weather conditions threaten cows' teats with frostbite. This is especially true regarding whether or how to dip teats at milking time when cold wind chill is present.

In the Northeast, this issue especially revolved around three options that were considered and debated for years before I arrived, and continue to be to this day, and I think they are relevant to many parts of Utah:

- Continue dipping teats with a liquid (or liquid foam) teat dip regardless of weather?
- Dip with a powdered teat dip when frostbite conditions arrive?
- Stop dipping teats entirely when frostbite is a threat?

However, I have not seen a controlled study to scientifically evaluate some of the teat skin and milk quality outcomes using powdered versus liquid teat dip until recently. A paper by K. Morrill et al. in the Journal of Dairy Science, March 2019 reports on a field trial to address this question.

The study compared a powdered 0.5% chlorhexidine acetate-based postmilking teat dip (PD, Derma Soft n' Dry, IBA Inc.) with a foamed 1% iodine-based postmilking teat dip (ID, FS-103, IBA, Inc.) during winter weather. Holstein cows housed at the Miner Agricultural Research Institute in New York State were studied between January 4 and February 16 several years ago. I was somewhat curious about the study dates, but the authors stated that they were chosen "because it is normally the coldest time of the year in northern New York, and the cows were not enrolled in any other research trials". I do think that date range makes sense, but one can see that it also probably fit their schedule relatively conveniently; that is a practical factor in research.

There were 3 types of cow housing: a freestall barn and a tiestall barn, both with foam mattresses bedded with sawdust, and a freestall barn with deep sand bedding. Milking was 3X in a double 12 parallel parlor. Milking routine included forestripping and pre- and postmilking teat dip.

Outside weather data (temperature, wind speed, gust speed, and relative humidity) were collected hourly at institute's weather station near the barn. Inside the barn, temperature and humidity were recorded with data loggers (HOBO U23 Pro v2 Temperature/Relative Humidity Data Logger, Onset Computer Corporation) in the freestall and tiestall areas every 15 min. A completely randomized block experimental design was used; cows were blocked by housing location (freestall mattress, tiestall, freestall sand), lactation number (1, 2, or 3+) and stages of days in milk (DIM 1-29, 30-89, 90-179, and $\geq$180). This resulted in 36 blocks (3 x 3 x 4). For all cows within each block (e.g. freestall mattress, Lact 2, 90-179 DIM), they were randomly assigned to either the PD or ID treatment group by a coin flip. This resulted in no selection bias and therefore no confounding because each teat dip experimental group was allocated evenly among cows by housing, parity and stage of lactation. Colored leg bands were used to ensure that every cow was teat dipped with the appropriate type of dip (her treatment group) throughout the study.

Evaluation of intramammary infections (IMI) was not ideal in the trial; quarter milk samples were cultured using NMC guidelines only on the first (day 1) and last (day 44) days instead of weekly or possibly twice weekly during the study; therefore no data on new infection rates or whether IMI were new or chronic was obtained. However, if cows had signs of clinical mastitis, which were not described or defined, milk from each of the 4 quarters was cultured on the day of detection. The paper includes a description of how many different bacterial colony types resulted in a definition of "mixed infection" or "contamination", but it is confusing and seems to have overlap. (In nearly 35 years of working largely in mastitis and milk quality, I acknowledge that it is difficult to objectively decide if mixed milk cultures are contaminated or not, especially if major pathogens such as *Staphylococcus aureus* are present in an otherwise not very pure culture.)

The paper states, "Quarter level SCC was evaluated using flow cytometry (SomaScope, Delta Instruments)", but does not describe how often. According to the results, SCC apparently was measured only on day 1 and day 44 of the trial as well, again omitting any true measure of new IMI or chronicity of high SCC being captured. Teat end score and teat skin condition (TSC) were assessed on days 1, 24, and 44. Teat end scoring used a 5-point scale: (1) teat end sphincter is smooth with no evidence of irritation, (2) teat end has a raised ring, (3) teat end sphincter is roughened with slight cracks but no redness is present, (4) teat end sphincter is inverted with many cracks giving a flowered appearance, and (5) teat end is severely damaged and ulcerative with scabs or open lesions. TSC was evaluated on a 3-point scale: (1) normal/smooth, (2) dry/slightly rough, (3) cracking/open lesion. Teat ends and TSC were evaluated by the same person each time.

SCC was transformed to Linear Score (LS) for some statistical analyses, and categorical variables lactation number and DIM stage were also analyzed as continuous variables, reporting their means, as were the means of milk production, temperature and humidity. (Daily milk production was reported in results, but there was no description regarding how it was measured; possibly daily milk weight recording in the parlor was used?) Much of the data was analyzed using linear mixed models in SAS, including allowance for repeated measures on the same cows or quarters.

The 331 cows were teat dipped with PD (n = 154) or ID (n = 177). It can be seen that quite a few more cows in the PD group did not complete the trial compared with the ID group, which is not a minor outcome considering this was only a 44 day study. The paper states, "The difference in cow numbers between treatments was due to cows being dried off or leaving the herd before the end the trial. No cows on the trial left the herd because of IMI." Conversely, even though this was a relatively short trial, it is remarkable that none of the cows sold or died were attributed to IMI considering this relatively large difference between groups in cows leaving the study (neither the beginning number of cows enrolled or any numbers of how many cows left the study for what reasons were shown). Table 1 below is modified, including conversion from kg to pounds, and compares characteristics between cows assigned to the two treatment groups at the beginning of the trial.

Table 1. Characteristics of cows assigned to powdered (PD) or foamed iodine (ID) teat dip treatments at the beginning of the study. Means and range of values shown for each treatment group.

Parameter	PD	ID
Lactation number	2.1 (1 to 7)	2.1 (1 to 6)
Days in milk	152 (2 to 424)	144 (1 to 446)
Milk/day (lb)	94 (8 to 165)	69 (26 to 149)

The authors state that there were no differences between the treatment groups in Table 1, but no statistics are shown. Biologically it can be seen that there was a marked difference in milk production, but I don't suspect that teat end or teat skin condition are affected much by milk production level.

There were 24 hourly measurements/day x 44 days = 1056 measurements of each weather statistic, with the following means and ranges: Outside temperature 21° F (- 18 to 41° F), wind speed 3 mph (0.2 to 14 mph), wind gust (what defined a gust and how measured were not explained) 10 mph (2 to 26 mph), relative humidity 61% (20 to 95%). (Relative humidity is certainly one weather characteristic that is markedly different in the high desert in Utah than in many other parts of the country; I notice that whenever I travel to them). There was an average outdoor temperature below freezing on 37 of the 44 days of the study.

There were also 12,664 measurements of conditions inside the barn: temperature 42° F (20 to 63° F); only 1% (n = 121) of all measurements inside the barn had a temperature below freezing. I attended many farm visits or continuing education/extension events in upstate NY where there were discussions about the difference in outside weather conditions, especially when cows walked through a return alley and back to housing with only a board fence between them and outside weather, and the within-the-pen temperatures. The consensus was that as long as cows exited the milking environment with their teats wet, their exposure to the outside weather such as in a return alley or in housing open to the outside was the major risk of frostbite. My experience agrees with that. Relative humidity within the barn was 77% (36 to 100%).

Again, there was no measure of incidence rate or chronicity of mastitis; at onset of the trial, 83 PD and 62 ID quarters had SCC >200,000 cells/ml; at the conclusion, 120 PD and 128 ID quarters had a SCC >200,000 cells/ml. This was not statistically significant, but no P values were shown; biologically and economically it seems to me that the PD cows increasing by 37 IMI (24% of their final group size) was certainly less than the ID cows increasing by 66 IMI (37% of their final population). The apparent failure to detect this statistically was probably due to insufficient sample size as well as no milk samples being tested except at the beginning and end of the study. However, there was a remarkable lack of differences in other outcomes between the teat dip groups as well as within stage of lactation or parity: LS average was 2.1 in PD, ID, every range of DIM, and within lactations 1, 2 or 3+. TSC was 1.32 to 1.39, with nearly all means between 1.32 to 1.34 within the above categories, with PD 1.35, ID 1.34. Teat end score was 2.72 to 2.77, with most means between 2,72 to 2.75 within all categories of cows, with PD 2.72, ID 2.77. The latter was actually found significant at $P < 0.05$, but this certainly does not appear to be a biologically significant difference in teat end scores.

The authors noted that while treatment was not associated with TSC, it's mean value improved during the trial for all cows (1.4 to 1.3, $P < 0.001$). In contrast, the proportions of cows with TSC of 1 (normal/smooth) were: day 1 PD 76%, ID 75%; day 24 PD 61%, ID 62%; day 44 (end date) PD 69%, ID 71%.

There were only a few differences in number of IMI between the teat dip groups: *Klebsiella* spp. PD 2 IMI, ID 6 IMI all on day 44; coagulase-negative staphylococci (CNS) PD 84 IMI increased to 104 IMI, ID 100 IMI decreased to 73 IMI; *S. aureus* PD 5 IMI increased to 18 IMI, ID 7 IMI increased to 9 IMI. Driven by CNS and *S. aureus*, PD was associated with greater risk for developing a new IMI (relative risk = 1.51; 95% CI = 1.10–2.07; $P < 0.05$); therefore PD dipped cows were 51% more likely than ID dipped cows to develop an IMI during the 44 day trial. There was no statistical analysis of clinical mastitis because there were only 6 cases in each treatment group (n = 12 total).

There was no mention of and no evidence of frostbite during the study period. The major conclusions of the authors were that powder teat dipped cows were more likely to contract mastitis caused by CNS or *S. aureus*, and had slightly worse teat end scores. However, what I see in the results is that SCC-based IMI (SCC > 200,000/ml) were markedly biologically increased in foamed 1% iodine dipped cows, and teat ends (and teat skin condition, which the paper also found not different) showed no practical or biological difference between the teat dip treatment groups. Because there was no frostbite observed during the study, there was no definitive answer regarding whether powdered or liquid teat dip (or not dipping at all) are the "best" practice to prevent frostbite. Nevertheless, I commend the authors for studying this issue, and overall it seems that powdered teat dip is similar if not better in preventing increased SCC

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than foamed dip, and the absence of liquid on the teat skin may be a true advantage if wind chill is sufficient to cause frostbitten teat ends. I have recommended use of powdered teat dip when wind chill is lower than - 30° F, and especially when below - 40° F, and I plan to continue doing so. What do our readers think, including based on practical experience?

UVMA Cancels the MountainLands Conference

The Utah Veterinary Medical Association has cancelled the MountainLands continuing education conference that was planned for Thursday December 9 through Saturday December 11, 2021 in Park City, Utah. There will still be an online, likely via Zoom, membership meeting at 10 a.m. on Sat. Dec. 11, 2021 (see UVMA website, utahvma.org).

The reason given by the UVMA was related to the unfortunate continuing pandemic situation and also a likely consequence of this being a new location and time of year for a UVMA conference; the pre-registration numbers were below the number of registrants required for the conference to break even financially. The lineup of speakers and topics was excellent, but the decision had to be made for the sake of responsible financial management of the UVMA.

As always, I hope our readers have a great holiday season. Please let us know your comments and suggestions for future topics. I can be reached at (435) 760-3731 (Cell), or David.Wilson@usu.edu.

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