DAIRY VETERINARY NEWSLETTER

March 2017

National Mastitis Council Meeting Coming to Boise, ID in July 2017

The National Mastitis Council (NMC) Regional Meeting is coming to Boise, ID this year, on July 19-20, 2017. The chair planning this year's meeting, Dr. Allan Britten informs me that the final detailed agenda for the meeting will be released in the next few weeks.

The current NMC statement regarding the upcoming summer meeting in Boise:

"Milk quality experts from the Northwest invite you to attend this year's **National Mastitis Council (NMC) Regional Meeting July 19-20 at The Grove Hotel in Boise, Idaho**. July 19 features a variety of interactive short courses and dairy farm and meat packing plant tours. On July 20 during the general session, presenters will address milk quality as it relates to parlor throughput, automatic milking systems, organic dairy production, contagious mastitis and beef carcass quality.

'The overall aim of the regional meeting is to help dairy producers produce and market higher quality milk,' said Allan Britten of Udder Health Systems, Meridian, ID, and chair of this year's regional meeting.

This year's regional meeting program is targeted toward mastitis/milk quality specialists, dairy producers and their employees, veterinarians, researchers, extension specialists and students who have an interest in high quality milk production. NMC is a Registry of Approved Continuing Education (RACE) provider. Thus, veterinarians attending the meeting can earn continuing education (CE) credits. Additionally, conference attendees can earn American Registry of Professional Animal Scientists (ARPAS) CE credits."

I hope that many of my colleagues in dairy veterinary medicine can attend this meeting, especially considering that it is so relatively close in our part of the country.

Chitosan: A Possible Non-antibiotic Treatment for Dairy Cattle Infectious Diseases?

There has been a pattern for some time that when some countries in Northern Europe enact new regulations regarding livestock agriculture, particularly regarding antibiotics, those regulations are eventually adopted here in the U.S. They seem to follow in approximately 10 years. This subject recently came up at the Mastitis Research Workers conference. There is increased speculation about a subject area that is not new, routine antibiotic use in dairy animals such as blanket dry cow therapy, medicated milk replacer (now requiring a VFD), etc. The supposition that sometime during the next decade or so, treatment of dairy cattle diseases such a mastitis, metritis, diarrhea or respiratory disease with antibiotics is likely to be further restricted is increasingly common within the U.S. dairy industry. Counter-arguments such as a growing need for food, demonstrated financial benefits, etc. may well lose out to public demand for less antimicrobial use in food production.

(Ironically, in some parts of Europe some aspects of regulation of antibiotic therapy on farms are being reduced.) There is as much speculation as ever regarding possible non-antibiotic treatments for disease in U.S. livestock, including dairy cattle.

A good review article in the February 25, 2017 issue of Drovers magazine by K. Elliott addresses chitosan, a sugar from the shells of crustaceans, as a potential treatment for infectious diseases, including in dairy cattle. The entire article can be found at: http://www.progressivedairy.com/topics/herd-health/chitosan-microparticles-a-potential-alternative-treatment-to-antibiotics

"The shells of lobster, shrimp and crab are treated with an alkaline substance such as sodium hydroxide to produce chitosan." Kwangcheol "Casey" Jeong, a faculty member in the Emerging Pathogens Institute at the University of Florida, developed the process to engineer chitosan microparticles. Dr. Klibs N.A. Galvao, faculty in the College of Veterinary Medicine at University of Florida, states that "chitosan microparticles [have] broad-spectrum anti-microbial activity".

The article mentions metritis and mastitis as the two most expensive diseases in adult dairy cows. "'Chitosan microparticles work by killing the bacteria in the uterus,' Galvao explains. Although the mechanism is not completely known, these microparticles bind to bacterial cells and directly affect the permeability of the outer membrane." Chitosan is described as highly biodegradable and non-toxic. "When used as directed, it has not shown harm to people, pets, wildlife or the environment."

Some other established uses of chitosan are described in the article, including "an edible coating used to double the shelf life of food. It is used in the manufacturing of cheese, wine and beer [and] as a seed coating for cotton, corn, soybeans, wheat and many other seeds".

Regarding treatment for mastitis and metritis, there is a description of a research trial at a large commercial dairy in Florida, with some quotes from the dairy owner regarding participation in research. No cure rate data or numbers are reported from the trial. However, the researchers acknowledge that so far the cost is impractical: "'The treatment (regimen for a cow) right now costs around $200 because we manufacture the microparticles in the lab,' Galvao explains. 'This method is very labor-intensive so most of the cost, approximately 85 percent, is labor.'"

I searched for some refereed journal publications on chitosan and bovine disease treatment. I found a great many papers on chitosan, but only two that reported on treatment of dairy cows, one on dry treatment and one on metritis:

Dry cow treatment with chitosan

A new paper by Lanctôt et al. in J Dairy Sci, March 2017 describes chitosan intramammary infusion (IMM) at dryoff. 7 Holstein cows were treated by IMM at dryoff, and each cow had 4 different treatments administered, one per quarter: 5 ml sterile water, 2.5 ml 5% low-viscosity chitosan solution (LVC), 5 ml 5% LVC, or 5 ml 5% high-viscosity chitosan solution (HVC). 8 more Holsteins were also treated IMM at dryoff, one treatment per quarter: 5 ml sterile water, 5 ml 2% LVC, 4 g of Orbeseal teat sealant, or Orbeseal + 5 ml 2% LVC.

A 6-point scale that was apparently based on gland palpation was used to assess "inflammation". SCC, bacteria count, bovine serum albumin, lactate dehydrogenase, and lactoferrin were tested in mammary secretions collected 1, 3, 5, 7, and 10 d after dryoff. On d 1, inflammation scores were significantly higher for some chitosan treatments, but with 1= normal, 2 = slight swelling, no mean scores were above 1.39. During 2 - 7 d post-dryoff, inflammation scores were not different between any chitosan treatments or controls, range 1.05 to 1.28, rounding to a score of normal. During the first week after dryoff, SCC, BSA, LDH, and lactoferrin were

all increased in chitosan treated quarters compared with the water control (ANOVA, $P \leq 0.05$). One conclusion by the authors was, "the intramammary infusion of chitosan hydrogel at drying off disrupted tight junction integrity and changed the cells' secretory state, therefore hastening the (mammary) involution process (after dryoff)." The authors also state that chitosan's association with IMI during the dry period needs to be evaluated, but that it "could be used as an alternative to dry-cow antibiotic therapy for uninfected cows". Obviously if chitosan continues to be recommended only for uninfected cows, it is not a complete replacement for antibiotic dry cow therapy.

Intrauterine treatment with chitosan post-calving

A paper by Daetz et al. in J Dairy Sci, November 2016 studied intrauterine chitosan for "preventing metritis in lactating dairy cows". Holstein cows from a large commercial herd that were defined as at risk for metritis (had one of the following: abortion, dystocia but excluding fetotomy or cesarean, twins, stillbirth, or retained placenta) were studied. The authors used a method to calculate their sample size (of n = 104) that I nearly always use; they determined the % difference in metritis prevalence that they considered biologically significant (either 28% vs. 45% or 62% vs. 45%) and determined whether they could detect it at an alpha - critical P value - of 0.05. This method means that there is no risk that something considered biologically important will not be statistically detected because of small sample size. 40 first calving cows and 64 multiparous cows were randomly assigned to 1 of 2 treatment groups by flipping a coin for each pair of cows, probably in order of calving but that was not specified. Treatments were: 8 g chitosan microparticles (CM) in 40 ml sterile water, or 40 ml sterile water, infused intrauterine from 1 to 5 d post-calving. "The treatment dose of 8 g/d was calculated to achieve a concentration of at least 0.2% of CM in the uterine lumen, assuming the uterus holds a volume of approximately 4 L."

Vulvovaginal lacerations were evaluated using a scoring system from 0 to 2 with 0 being none. Whether cows were blocked and then randomly enrolled based on lacerations was not clear. Rectal temperature, plasma concentration of β-hydroxybutyrate (BHB) and some other metabolic parameters, and body condition score were evaluated until 14 DIM, and daily milk yield until 30 DIM. The main outcome variable was cumulative prevalence of metritis, diagnosed using a uterine discharge scale: "1 = clear or translucent mucus; 2 = not fetid, normal lochia (viscous; red, brown, or clear); 3 = not fetid; thick mucus; cloudy, clearing, or clear; 4 = not fetid; may be purulent, mucopurulent, or chocolate brown; and 5 = watery, reddish or brownish color of fetid discharge." Only a score of 5 on the above scale was defined as metritis. Metritis presence or absence was evaluated at 4, 7, 10, and 14 DIM.

Cumulative incidence of metritis, which is not an incidence rate but just the proportion of total cases of a disease in a group over a designated time period, was calculated. Many outcome variables, including milk production (mean 30 kg, 66 lb/d) for first 30 DIM were not different between CM and sterile water treatments. Metritis was not significantly reduced in association with chitosan microparticle treatment either, up through 14 DIM (63.5% of chitosan treated cows vs. 73.1% of control cows, P = 0.28). I was surprised that metritis cumulative incidence was that high in both groups.

The authors concluded, "- - the duration of (chitosan) treatment may have to be extended, and dosage may have to be revised to maintain differences in the incidence of metritis after 7 DIM. Results from this study indicate that CM may be a viable alternative to traditional antibiotics for the prevention of metritis."

I think that further studies on the use of chitosan as a possible non-antibiotic treatment for infectious diseases in dairy cattle are warranted. I suspect that if indeed it were to be shown effective, the economy of scale with greater production would help decrease the cost of chitosan as a bovine treatment. However, so far it seems that efficacy in vivo in cows against mastitis or metritis is not clearly established, and the cost will need to be

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decreased if it is to be practical. Also, just because a compound is described as non-antibiotic does not automatically satisfy the FDA or other regulatory agencies that it qualifies as “organic”, safe in food animals, or having no meat or milk withholding time. Residue studies would need to be conducted as well.

Please let us know your comments and also suggestions for future topics. I can be reached at (435) 760-3731 (Cell), (435) 797-1899 M-Tues, (435) 797-7120 W-F or **David.Wilson@usu.edu**.

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