DAIRY VETERINARY NEWSLETTER

January 2013

Extreme Cold Weather is Resulting in Livestock Losses

Animals are being fed, and are eating, but body condition is poor in this year's cold

During this year's cold winter weather, the Utah Veterinary Diagnostic Laboratory has had a noticeable increase in the number of cases where cows or calves have died with little or no body fat present. These are not cases of animal neglect or absolute starvation, but rather where there has not been sufficient feed to meet energy needs caused by the consistently low environmental temperatures this year.

Depletion of body fat stores has been seen in adult cows, but more commonly in young dairy or beef calves with body weights between 65 and 120 lb. Some cases have elevated levels of iron in liver, which is consistent with catabolism of muscle to meet energy demands. Characteristics of these cases include:

- There is feed such as roughage and corn in older animals, or in the young calves, clotted milk, found in their G.I. tracts.

Lesions seen include:

- Animals present in poor body condition, with virtually no body fat or with serous atrophy of fat, including pericardial fat (all cases)
- Enterocolitis
- Diarrheal feces
- Ulcers in reticulum
- Bronchopneumonia (incidental, not cause of death)
- Tracheitis
- Aspiration pneumonia in cranial lung lobes (agonal)
- Nephrotoxicity - renal cortical tubular mineralization - attributed to antibiotic therapy

Pathogens isolated (most animals have had no diagnostic testing for pathogens because no active infectious lesions were seen) include:

- Bovine rotavirus in calf feces
- *Cryptosporidium* spp. in calf feces

In all cases, the lack of body fat and/or catabolism of muscle are such that negative energy balance has been diagnosed as the major cause of death.

Increasing Feed to Cows and Calves during Cold Weather

As reported in this newsletter in December 2009, Dr. Rob Harding presented information showing that compared with temperatures between 59° F and 77° F, calves need 50% more milk or milk replacer when outside temperature is freezing at 32° F, and when outside temperature is -4° F, they need 100% more. A time-tested rule for feeding calves milk or milk replacer remains that at pleasant outside temperatures they should be fed 10% of body weight per day; divided over two or three feedings per day. Therefore the total daily volume fed = 1 pint (one pound liquid) per 10 pounds of body weight. Thus a 125 pound calf (at ambient temperatures between 59° F and 77° F) would be fed 12.5 pints (also equal to 6.25 quarts) of milk or milk replacer per day. When the outside temperature is 32° F, those numbers would be multiplied by 1.5, and at -4° F, they would be doubled.

A rule for feeding cows during cold weather is that for every degree that the temperature is below 30° F (a critical temperature for cows), including the effects of wind chill which are approximately one degree per mile per hour, a cow needs one percent more feed. For example, at -20° F with 10 m.p.h. wind, wind chill is approximately -30° F, which means cows need 60% more feed than at 30° F because of the effective 60° difference. Being in barns or other structures with any artificial heating and/or protection from wind makes a tremendous difference to cows (and people, dogs, etc. of course) during cold weather.

Genetic Evaluations of Dairy Animals – Private Industry Will Now Calculate and Provide Them

After nearly 90 years, genetic evaluations of dairy animals and the summarization and presentation of the information is transferring from USDA's Agricultural Research Service (ARS) to private industry. As reported in Progressive Dairyman Jan. 1, 2013 by Calvin Covington, genetic evaluations and selection of the parents of the next generation have helped make major gains in milk production per cow. ARS does not provide genetic evaluation to other industries, they state that the dairy industry is ready to assume this responsibility, and the USDA continues to deal with budget cuts.

Within ARS, the Animal Improvement Programs Laboratory (AIPL) distributed dairy genetic evaluations to the industry. According to multiple sources, AIPL will now focus on research and development so exactly how much money will be saved in the budget for AIPL is not known yet. I found an article where a "key official" was interviewed regarding the change, and as is not uncommon when talking with those in senior levels of government, the answers were not completely explanatory of exactly what will happen and when. What is clear is that AIPL intends to eventually be involved only in research on genetic evaluation methods, and exactly how much help they will provide to dairy industry organizations or what the timetable is for the complete transfer of reporting responsibilities to industry is remains uncertain.

A subject getting quite a bit of attention in this transition is genomics, literally the study of the entire genome, or all DNA, within an individual. Genomic methods often study large parts of the genome of cows, humans, etc. but not the entire genome. As reported by Covington and others, there has been some thought that genomic testing means that genetic evaluation of bovines or other animals can be done without continuing to collect phenotypic data, the actual size, milking performance, foot and leg soundness, etc. of individuals or their offspring. However, nearly all, including the AIPL, agree that genomic prediction equations still need to be refined by collection of phenotypic data. An AIPL statement says, "One of the concerns from many in the dairy industry is the continued funding of data collection, quality control and evaluation. The dairy genetic evaluation program is not sustainable without continued and complete access to new phenotypic, genotypic, and ancestry data." What makes this especially important is the cost of collecting data such as milk weights, milk components, type classification of cows, etc.

This data collection has been and will apparently continue to be the task of the Council on Dairy Cattle Breeding, an organization of artificial insemination, DHIA, breed registry, and dairy records processing center businesses. Details of a new agreement between the Council and ARS/AIPL are being worked out.

AIPL has also stated, “Reports on genetic trend data, inbreeding data and annual reports of industry data like production statistics, and breed averages have been valuable to the industry so are expected to be continued as a cooperative venture where AIPL monitors the reports and develops new ones, as needed, and the industry personnel run the reports and maintain the web site that delivers them.” The industry apparently refers to the Council, which in addition to continuing data collection, will likely now summarize and distribute genetic evaluation reports. The Council estimates the costs to be approximately $1.2 million the first year, increasing to nearly $2 million by the third year.

One statement by the Council said, “Without a new agreement, serious inequities could develop between those producers, breeders and A.I. companies that help fund data collection efforts and those groups that would like access to the data without contributing to its collection. - - ARS has stated that [the current] agreement will cease in 2013.” In the article by Covington, he states, “Money to operate the council’s business unit will primarily come from fees - - for genetic evaluations for cows or bulls. - - For example, dairy farmers who register and classify their cattle may pay a lower fee for a genetic evaluation on one of their cows compared to a dairy farmer that does not.”

Some voices in the industry say that this is an inevitable change for the better. However, many see reason for some concern that instead of a neutral public government agency calculating genetic evaluations, there could be more potential for bias in dairy cattle genetics when they are evaluated by private industry. Dairy cattle veterinarians and their clients should be aware of the new changes coming and be encouraged to make comment to the AIPL and Council on Dairy Cattle Breeding and its member organizations.

Is Antibiotic Treatment of Clinical Coliform Mastitis Cost Effective?

A study of coliform mastitis

A paper published in the December 2011 issue of the Journal of Dairy Science evaluated treatment of some types of coliform mastitis cases. The message has been presented several times in the dairy popular press that the study described shows benefit to treating mild or moderate (severe cases were excluded) cases of clinical coliform mastitis with 5 d ceftiofur, compared with no treatment, and implying that this should become routine practice on dairy farms. However, the study authors’ conclusions do not make any such management recommendations. It is a good idea to evaluate the practice of extended therapy for cases of clinical mastitis in my opinion. There is some biological and pharmaceutical logic in considering whether we should treat clinical mastitis cases for longer than just a few milkings, aiming to achieve a higher proportion of bacteriological cures, eliminating the causative bacteria. Of course along with longer treatment duration comes not only increased drug cost, but also increased cost from withholding more milk. No evaluation of cost-effectiveness based on the study results has appeared. I decided to use the results presented in the paper and estimate the costs and benefits of the treatment protocol described.

The study took place on 5 commercial dairy farms milking between approximately 500 and 750 lactating cows, with good milk production. Bulk tank SCC were relatively low, except on one farm, but all were below 360,000/ml. Cows were eligible if they had not been treated with antibiotics for at least 14 d, had no “severe teat lesions”, were at least 25 d before expected dryoff, and had not been included in the study before. Using a clinical scoring system, mild or moderate clinical mastitis cases detected in only one quarter were enrolled, but severe cases (mainly differentiated by systemic signs such as fever or depression) were not. Cows with more than one quarter detected with clinical mastitis were also excluded.

A pre-treatment aseptic milk sample was cultured, treatment (or untreated control) of the clinical quarter was begun, and cows remained in the study only if a 24 h culture result showed coliform bacteria in milk. Four of the 5 farms had on-farm microbial culture labs, but “eventually” cows were only included when the coliform isolate was confirmed at a university laboratory, using accepted microbiology methods. Treatment was ceftiofur hydrochloride 125 mg intramammary infusion at 24-h intervals for 5 d, or untreated control. Cows were evaluated for bacteriological cure, clinical cure, or clinical improvement. A nice feature of the study was use of random amplified polymorphic DNA (RAPD)-PCR typing of bacteria from 87 of the 104 cases; if a different RAPD typed strain of the pre-treatment bacterial species was identified in post-treatment sample(s), the case was defined as a bacteriological cure followed by a new infection. Bacteriological cure was absence of the bacteria found in the pre-treatment sample from both post-treatment samples (including possibly the isolation of a different strain type if genus and species was the same, but this was rare). Most cured cases had no bacteria isolated after treatment, and most post-treatment isolates of same genus and species as before treatment were the same strain, and thus a non-cure.

Study design was good, but bacteriological cure rates were only monitored based on cultures at 7 d and 14 d after the last treatment, in contrast to most studies where post-treatment cultures to evaluate whether the infectious bacteria are gone are done until 21 or 28 d or even longer after the last treatment (Sol et al., J Dairy Sci Nov 1997; Oliver et al., Vet Ther Fall 2003; Pinzon-Sanchez et al., J Dairy Sci July 2011). When post-treated mastitis cases are only cultured for 14 d, apparent cure rates for cases treated with antibiotics are nearly always higher than when they are followed longer (Wilson et al., Proc Natl Mast Council Reg Mtg 1993). As the authors acknowledged in the paper, the difference in bacteriological cure rates reported between antibiotic treated cows and untreated controls was noticeably higher than those reported by most previous studies, which they attributed partly to inclusion of only mild and moderate clinical mastitis cases.

There were 104 clinical mastitis cases enrolled, 56 ceftiofur treated and 48 controls. Bacteria isolated from treated and control cows, respectively were: *E. coli* 29, 19; *Klebsiella* spp. 20, 18; *Enterobacter cloacae* 7, 11. Cow characteristics such as days in milk, daily milk production before onset, etc. were not different between the 2 groups. Ceftiofur bacteriological cure rate was 41/56 (73%), untreated control cure rate was 18/48 (38%). There were 4 cows, among the 17 with no strain typing, that exactly whether or how their cases were defined as cures or non-cures was not clear. One thing that was unusual in this paper, that I have never seen before, was that missing milk samples resulted in definition as bacteriological failure, and this happened to 12 (25%) of the controls but only 6 (11%) of the treated cases. If cases with missing samples were excluded, the cure rates would be 18/36 (50%) for untreated controls and 41/50 (82%) for treated cases, a slightly smaller difference. Cows that were culled for any reason were also defined as non-cures, which the authors acknowledged might be a source of bias. Whether cases of clinical mastitis were bacteriologically cured cannot be inferred from culling, especially when mastitis is not specified as the reason for culling.

Nevertheless, I used the cure rates in the paper to try to estimate cost-effectiveness. If one uses the 73% and 38% cure rates above, an easy way to proceed is to analyze an example where 8 clinical mastitis cases were treated with ceftiofur and 8 cases were not treated. If 6/8 treated cases (75%) and 3/8 untreated cases (38%) were bacteriologically cured, these would be essentially the same cure rates as in the study. Of course any sample size can be used, and the per-cow results will be the same, but 16 cows makes an easy example with the percentages in the paper. The milk price and treatment tube costs below are from current Utah prices in January 2013.

One of the major challenges in estimating cost/benefit in mastitis treatment is determining how much value (savings) to assign to a cured case of clinical (or subclinical) mastitis. How much of the average loss attributed to a case of mastitis is "saved" when a cow contracts mastitis, is treated, and the bacteria are eliminated? What proportion of the total financial loss is saved when a mastitis case is "cured" has not been the subject of much published research. Shim et al., J Dairy Sci Aug 2004 studied something close to this question, comparing total milk loss following clinical mastitis (mostly cows with only one case per lactation) between cows treated with antibiotics plus supportive treatment with supportive treatment alone. Because no milk cultures were done, the agents as well as bacteriological outcomes were unknown. The authors found considerable variability between cows, but the mean milk production among antibiotic treated cows was 230 kg (507 lb) higher for the remainder of lactation compared with supportively treated cows. A paper by Ostergaard et al., J Dairy Sci Dec 2005, used complex modeling and estimated the amount of milk/cow/yr gained by "elimination" of various etiologic agents causing mastitis. The amount gained for eliminating infections varied between pathogens, including *E. coli* and *Klebsiella* spp., but the amount of milk gained per yr for those specific pathogens was not broken out individually in the paper. I decided to give antibiotic treatment the "benefit of the doubt" by using their most optimistic estimate, one assuming that all mastitis infections were eliminated, 392 kg (863 lb) per year. This estimate is clearly high because Ostergaard et al. found that more milk was lost due to some Gram-positive pathogens than from coliforms, and such cases were unlikely to be present in the 2011 study; they would have had to have been present in the same clinically mastitic quarters but missed by culture procedures that detected only *E. coli*, *Klebsiella* spp., and *Enterobacter cloacae*. The estimated milk production gained by a bacteriological cure shown below is from the average of the two above published estimates, 507 and 863 lb, a mean of 685 lb.

Also, there was reduced culling or death associated with treated cases; 7/56 (13%) of treated cows and 9/48 (19%) of untreated cows were culled or died (no breakdown of culled or died, or what the primary reason for culling was, were shown). A recent estimate of culling losses as a result of mastitis (I still thought it best to use mastitis culling estimates because that was inferred in the paper, and they were mastitic cows) was $1087.00 per cull from mastitis (Heikkila et al., J Dairy Sci Jan 2012), used in the calculations below.

Cost and benefit estimates (8 treated cases vs. 8 untreated cases) follow:

Milk discard and antibiotic costs for 8 treated cows:
8 clinical mastitis cases treated x 8 d (5 d Rx + 3 d withdrawal)/case x 100 lb milk/d (treated cows in study averaged 100.4 lb) x $19.00/cwt = $1216.00 milk discard expense
8 cases treated x 5 tubes ceftiofur/case x $4.20/tube = $168.00 drug expense
There are other expenses with treated cases, but they are usually ignored in these calculations because they are variable among farms, and relatively small (e.g. labor, leg bands, etc.)
Total milk discard and antibiotic costs for 8 treated cows = $1384.00

Value of increased milk production and reduced culling for 8 treated cows:
3 additional cures (per 8 cases) compared with untreated cows x 685 lb/lactation/cure x $19.00/cwt = $390.45 value of more milk because of cures
8 cows x 6% less cull rate than among untreated cows = .48 less cows culled (per 8 cases) x $1087.00/cull = $521.76 benefit from reduced culling
Total milk and culling losses saved for 8 treated cows = $390.45 + $521.76 = $912.21

Net financial difference for 8 treated cows:
(+$912.21 milk and culling reduced losses) – ($1384.00 milk discard and treatment expense) = -$471.79 (net loss of $58.97 per treated cow)

I plugged in 80 lb milk/d and made a culled cow a loss of $1500.00 (that is extremely high for a commercial cow). Then there was a net loss of $3.79 per treated cow. It makes sense that herds with lower milk production per day (*or lower milk price, a major factor because there is more milk discarded than gained back in production*) and with greater losses when a cow is culled would show less loss from extended therapy.

The paper also studied clinical cure, clinical improvement, milk production and SCC following treatment. These were less strongly associated with ceftiofur treatment, such as 54% clinical cure for treated cows and 46% for control cows, but still statistically significant, or were non-significant (milk production and SCC) between treatment groups. It is good to know that long-term milk quality or milk production were not decreased in association with no treatment compared with ceftiofur treatment of these mild or moderate coliform mastitis cases.

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If any readers think that the milk price, drug cost, etc. for their practice/area is substantially different than the estimates above, they can plug in their own values and do the calculations. It is also important that the 2011 paper does not discuss how many cows if any died instead of being culled; if there was for example .10 less cow that died per 8 cows treated or something like that (1.2% less died), that would affect the estimates somewhat because dying cows cost more than culled cows. Nevertheless, even with a high estimated cure rate difference (discussed earlier) and an optimistic estimate of the milk loss avoided by a bacteriological cure, the data does not suggest that routine treatment of mild coliform mastitis cases with a total milk discard time of 8 d is cost-effective. Apparently there is simply too much milk discarded.

It should also be noted that the ceftiofur treatment studied is labeled for daily infusion for as many as 8 d, but this study only evaluated 5 d treatment. I did not find published results regarding bacteriological cures or cost-effectiveness of 8 d treatment. We need more studies of this kind, including comparison of different types and durations of treatment on blocked similar cases of mastitis, especially clinical mastitis, in dairy cattle.

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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