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In This Issue

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From the (New) Editor – It is with mixed emotions that I take the helm of this newsletter that Dr. Moore has curated for the past 14 years. On the one hand, her retirement spells the end of constant access to an amazing mentor and friend. On the other hand, her newfound freedom may translate into an even greater abundance of garden produce and preserves to be shared around!

We are going to stay the course with quarterly newsletters and will continue to include diverse topics related to various livestock species. When possible, we will include updates from WSDA and WADDL, and intend to provide a new section highlighting livestock-relevant veterinary senior papers. During the final (4th) year of the DVM curriculum, students with the help of an advisor and discussant complete a manuscript and present their findings to the CVM at large. We look forward to providing you insight into topics that pique students' interests and provide grist for the intellectual mill.

I will wrap up by highlighting summer research projects being conducted by four of our rising 2nd and 3rd year veterinary students. We are working with regional dairies to explore impacts of early calfhood subclinical and clinical disease on longevity and future productivity. The specific projects include investigations into complete blood count and fibrinogen levels associated with calf disease, thoracic ultrasound findings associated with pneumonia severity and duration, and leukocyte gene expression and fecal microbiome changes related to both GI disease and pneumonia. The findings from these studies will inform forthcoming Veterinary Medicine Extension programs that we look forward to sharing sooner-than-later. In the meantime, I hope you enjoy this edition of the newsletter and look forward to connecting with many of you in the coming months.

General Livestock: Managing the Heat

By DA Llewellyn, Livestock Extension Specialist & CS McConnel, Veterinary Medicine Extension

As we continue to deal with extreme summer temperatures, please keep in mind the added risk to livestock and pets. Here are a few general suggestions to keep your animals safe, but also keep in mind each of the various species of domesticated animals with have specific needs.

- Avoid stressful handling of livestock and if necessary, only do so in the early morning hours or late in the evening.
- If animals are in a barn or shed, ensure that they have proper ventilation and air circulation.
- For animals outside, provide shade if possible.
- Provide a continuous supply of cool, clean water.

Water is an important factor in allowing animals' bodies to cool down and stay cool. Sufficient water is particularly important for animals that are lactating or pregnant to ensure health of the nursing young and health of offspring at birth. Watch for signs of dehydration (e.g. lethargy, drying of the mucous membranes and eyes, or eyes that appear sunken and dull). Clean water is also important: Note that excessive heat and stagnant water can promote blue-green algae growth which has shown to be toxic to livestock, wildlife, and humans. More information on blue-green algae can be found through North Dakota State University and the CDC veterinarian reference for cyanobacterial blooms.

Caseous Lymphadenitis in Small Ruminants: A Diagnostic Challenge

By Claire Burbick, Bacteriology Section Head

Abscesses on sheep and goats are of significant concern due to the possibility of the dreaded Caseous Lymphadenitis (CL). CL is a bacterial infection caused by *Corynebacterium pseudotuberculosis*, which can be production limiting and lead to carcass condemnation, wool issues, and chronic wastage. Identification of infected animals can be quite challenging if no abscesses are observed, complicating the ability to control introduction and spread of CL on the farm.

The gold standard for diagnosis of CL is culture of the bacteria from an abscess, which can be grown easily on standard culture medium. **Do not assume every abscess is CL.** Cultures performed at WADDL indicate about 60% of submissions are not CL, therefore it is essential to culture for accurate herd management. Submission of pus is preferred for diagnosis (either the material itself in a sterile leak-proof tube or by using a swab designed for bacterial transport) and once collected should be maintained at refrigeration temperature until the sample reaches the laboratory.

If no abscess is available for sampling, serology is another diagnostic option for risk assessment but should not be used in place of culture. Serologic testing using either the Synergistic Hemolysis Inhibition Test or ELISA can be used for herd-level screening. Ideally, when introducing a new animal the herd of origin should be screened to determine the risk for CL. If antibodies are detected in multiple animals it is likely CL is circulating and there is risk. If antibodies are not detected in the herd then the risk is reduced; however, false negative tests can occur so consideration still should be given to other management factors such as animal movement on and off the premise, or whether abscesses are cultured routinely. If herd of origin testing is not available, serologic testing and quarantine (2 tests a minimum of 30 days apart) may aid in understanding the relative risk of CL even though the presence of titers and the development of disease are not well correlated.

Lastly, vaccination can be used as a management tool to control CL and has long been used in sheep-producing countries such as Australia. The vaccine helps reduce abscess development and disease spread in herds with known CL, or at risk for CL. It should be noted that vaccination will produce antibodies that will be detected on serologic tests which complicates the use of serology for disease monitoring.

Resources: https://waddl.vetmed.wsu.edu/animal-disease-faq/caseous-lymphadenitis

Ruminants: Impacting Oxidative Stress, Physiologic Stress and Nutritional Stress Through Dietary Biochemical and Taxonomical Diversity

By CS McConnel, Veterinary Medicine Extension

A recent study out of New Zealand investigated the effect of a pelleted energy supplement with or without the addition of a *Lactobacillus*-fermented seaweed extracts on oxidative stress and milk production and composition from ewes during late gestation through to weaning (Beck et al., *Journal of Animal Science*, 2021, Vol. 99, No. 5, 1-11). Oxidative stress is defined as the imbalance between oxidants and antioxidants. Several stressors (e.g., transport, shearing, negative energy balance) have been shown to increase oxidative stress and the incidence of morbidity and mortality in livestock. Specifically, nutritional stress caused by negative energy balance perpetuates disorders such as mastitis, metritis, and retained placenta. Strategic supplementation with energy rich concentrates is one potential mechanism for reducing oxidative stress in transition and lactating animals. However, energy supplementation using starch may also increase oxidative phosphorylation and oxidative stress, especially around peak lactation. Alternative suggestions for reducing oxidative stress include feeding plant extracts such as seaweed products, or probiotic supplements based on *Lactobacillus* species.

In this study, it was hypothesized that energy supplementation alone would help alleviate the negative energy balance experienced during lactation by causing glucogenic shifts of ruminal fermentation patterns. Although the results indicated that a basal supplement (commercial pellet, 12.2% CP, 2% fat) altered fermentation patterns and increased butyrate, valerate and ruminal ammonia concentrations while reducing the acetate-to-propionate ratio, oxidative stress actually increased at peak lactation 4-wk post-lambing.

The seaweed-based extracts were expected to provide health benefits by providing plant secondary compounds (PSC; namely mono- and poly-phenols) and *Lactobacillus* fermentation metabolites. Oxidative stress was alleviated relative to the use of the pelleted energy supplement alone but remained elevated when compared to ewes that were not supplemented at all. This highlighted the potential for an overall increase in oxidative stress driven by energy supplementation, and possibly linked to changes in metabolism and oxidative phosphorylation. Nonetheless, the antioxidant activities of PSC and *Lactobacillus* fermentation products did suggest the potential for health benefits in animals that are fed energy concentrates.

If you have made it this far you may be thinking that the take-home message is that seaweed extracts may be beneficial but perhaps are not the miracle drug they are at times purported to be. That is true, but more importantly the study referenced above pointed to an earlier article by Beck and Gregorini (*Frontiers in Vet Sci,* 2020) that broadened the conversation to investigate how dietary diversity enhances well-being in grazing animals. That article provided an expansive review of oxidative stress, physiological stress, and nutrition as affected by dietary diversity. The authors provided evidence to support how dietary biochemical diversity (provided through taxonomical diversity) can reduce oxidative stress directly by providing plant secondary compounds as natural dietary antioxidants and indirectly by reducing physiological stress, which has been reported to influence oxidative status. Furthermore, the authors suggested that dietary diversity may improve well-being by allowing animals to make choices and by altering the microbial-gut-brain axis as well as improving nutritional status. Improved nutritional status subsequently can have beneficial impacts on oxidative stress by reducing energy store mobilization and physiological stress as well.

All told, these studies provided interesting food for thought regarding the links between dietary diversity and oxidative stress, physiological stress and nutritional status—areas that are obviously important to both producers and consumers alike.

Swine: Featured Collection on Social Behaviors in Pigs

By CS McConnel, Veterinary Medicine Extension

The Journal of Animal Science recently featured a collection of articles with summary slides and associated references covering topics related to social behaviors in pigs. Each topic includes a brief synopsis and an individual slide that can be downloaded for future reference and educational purposes. In all there are three topics covered including: 1) the impact of social effects on feeding duration of pigs at automatic feeding stations, 2) the effects of music stimulus on behavior, stress, and immune response of growing pigs, and 3) factors affecting performance response of pigs exposed to different challenge models. Results from these publications provide insight into the social behavior of young pigs and their possible effects on health and productivity.

1. Factors affecting performance of pigs exposed to different challenge models, Journal of Animal Science, Volume 99, Issue 6, June 2021, skab078, https://doi.org/10.1093/jas/skab078
2. Environmental enrichment and stress relief in pigs, Journal of Animal Science, Volume 99, Issue 5, May 2021, skab113, https://doi.org/10.1093/jas/skab113
3. Feeding behavior in pigs. Journal of Animal Science, Volume 99, Issue 5, May 2021, skab115, https://doi.org/10.1093/jas/skab115

Swine: Swine Health Information Center Disease Fact Sheets

By CS McConnel, Veterinary Medicine Extension

As we enter the season of livestock shows and county fairs it might be worth taking a look at recently updated Swine Health Information Center Emerging Disease Fact Sheets. Rather than serving as cause for concern, these fact sheets can highlight the importance of biosecurity both on-farm and at shows and fairs. Beyond that, they can prove quite interesting and draw attention to pathogens and disease states that you might not have considered previously. For example, the fact sheet regarding *Streptococcus equi* subsp. *zooepidemicus* provides a thorough summary of clinical features and characteristics of *S. zooepidemicus*, along with useful sections on cleaning and disinfection, prevention and control, and transmission that broadly apply to biosecurity principles. Although this specific pathogen may seem removed from our immediate concern here in WA given its isolated occurrences in the eastern U.S. previously in 2019, the underlying story regarding its appearance in Indiana provides an excellent reminder that no matter how well you think you know diseases there are things out there you have never seen before but might want to prepare for! On that note, check out the next section from the WA Department of Agriculture regarding biosecurity issues related to garbage feeding to swine.

Swine: The Skinny on Garbage Feeding to Swine

By Susan Kerr, WSDA Outreach and Education Specialist & Amber Itle, WSDA Assistant State Veterinarian

Garbage feeding was popular decades ago before much was known about swine nutrition, before food processors had markets for their by-products, most pigs were raised outdoors, and commercial swine rations were not widely available. Feeding damaged, over-ripe, unmarketable, or expired products from grocery stores remains a popular practice on small-scale farms to help reduce feed costs. However, such rations often lack sufficient protein for growing pigs and are at risk of spoilage or contamination if not properly stored, handled

and managed. Commercial rations provide diet consistency and meet animals' nutritional needs at various life stages much more effectively.

"Garbage" is defined as table scraps or food waste from caterers, restaurants, food processors, school cafeterias, or home kitchens that ***may include or have contacted meat, poultry, or fish***. Currently, garbage feeding to swine is allowed in Washington State if an applicant applies for and receives an annual license, pays an annual fee, abides by program requirements. Annual inspections ensure garbage is properly boiled for 30 minutes before feeding to swine to reduce the risk of disease transmission.

This year, the WSDA Animal Health Program is re-introducing Senate Bill 5300 into the legislature proposing changes to RCW 16.36.105 to prohibit garbage feeding to swine in Washington. If repealed, Washington will join 23 other states with laws that ban the practice. Bakery, vegetable, fruit or dairy waste is NOT included in this definition and is legal to be fed now and under the proposed ban. The actual risk is raw or undercooked meat, which could harbor disease-causing agents of concern.

The goal of proposed changes is to strengthen biosecurity and reduce the risk to swine and human health. Feeding garbage can transmit several economically devastating swine diseases of concern and can have public health implications (trichinosis). The biggest reason to adopt the proposed ban is to reduce the risk of introducing a catastrophic foreign animal disease such as African Swine Fever or Foot and Mouth Disease. The highest risk of acquiring these diseases is through the practice of garbage feeding.

In the last year, an ongoing global outbreak of African Swine Fever in 23 countries is estimated to be responsible for the death of at least 25% of the world's pig population due to the virus' spread throughout Asia and now Europe. Garbage feeding could introduce Foot and Mouth Disease to pigs that can pose risk to other livestock including cattle, sheep and goats as well as wildlife such as deer. Dealing with thousands of animal carcasses, either from death or large-scale euthanasia for disease control, would be devastating.

The final intention of the proposed change is to prevent the negative economic impacts to Washington livestock producers, farm communities, and our economy as disease outbreaks of this nature have long-term impacts on international trade, food security and consumer confidence.

Resources

USDA APHIS: What swine growers need to know about garbage feeding:
https://www.aphis.usda.gov/publications/animal_health/fs-swine-producers-garbage-feeding.pdf

USDA APHIS Swine Health Protection Act State Permit/Prohibit Status Map:
https://www.aphis.usda.gov/animal_health/animal_dis_spec/swine/downloads/swine-health-protection-map.pdf

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Cattle: Testing Your Tuberculosis Testing Knowledge

By Susan Kerr, WSDA Outreach and Education Specialist & Amber Itle, WSDA Assistant State Veterinarian

When moving cattle interstate or internationally, planning a dairy sale, or testing a herd to achieve accredited TB herd status, advanced planning by the veterinarian and producer is critical. When starting this process, check https://www.interstatelivestock.com/ to confirm the state of destination testing, identification and Certificate of Veterinary Inspection requirements.

The Caudal Fold Test (CFT): WSDA relies on accredited veterinarians to conduct TB surveillance by performing caudal fold tests prior to interstate or international movement. In order to perform Tuberculosis testing in Washington, Veterinarians must be type 2 accredited and pass the Bovine Tuberculosis Course found here. The official CFT tuberculin test should yield a false positive responder rate of 1-3%. The reaction may range from a palpable skin thickening to a visible lump in the caudal fold. USDA monitors the response rate reported by each accredited and regulatory veterinarian conducting official tuberculin tests as outlined in Appendix C of Bovine Tuberculosis Eradication Uniform Methods and Rules. Accredited vets with low response rates will be contacted by a state or federal veterinarian to address the shortfall and offer retraining. If a

veterinarian's responder rates don't align with expectations without valid justification, they are at risk of being reported to NVAP for removal of accreditation.

The Hold Order: When "responders" or suspects are identified by an accredited veterinarian, he/she notifies state or federal veterinary officials about test results. The regional WSDA field veterinarian will place a hold order on the farm to restrict animal movement and contain possible spread of disease until suspect cases are investigated. Other cattle in the herd may continue to move into slaughter channels but may not leave the farm for any other purpose until secondary tests confirm negative status. Usually, a hold order on a false positive is cleared in 3-7 days. If the test is confirmed positive, a quarantine will be issued until negative status can be achieved.

The secondary/confirmatory TB Tests: WSDA or USDA field veterinarians can determine if responder/suspects are true or false positives using the comparative cervical test (CCT) or bovine interferon gamma assay (Bovigam™ blood test). The two tests options must be completed within strict time intervals because the CFT acts as a "primer" for these confirmatory TB tests.

The comparative cervical test (CCT): A CCT must be conducted by a State or Federal Veterinarian within 10 days of the initial CFT injection. If the window for testing is missed, the CFT cannot be repeated for 60 days. The CCT requires animals to be restrained properly because the procedure involves clipping two spots on the animal's neck, measuring baseline skin thickness with calipers, and separately injecting bovine and avian tuberculin reagents. Three days later (72 +/- 6 hours), skin thickness at the two sites is compared, measured, and plotted to conclude if the status is suspect, reactor, or negative.

The gamma interferon assay blood test: The gamma interferon or Bovigam™ blood test is another way to conduct confirmatory TB testing. In some ways it is simpler because it involves one trip to a farm, a single blood draw, and minimal animal restraint. However, the National Veterinary Services Laboratory (NVSL) is the only lab approved to run the tests. Tests can only be run Mondays through Wednesdays, requiring advanced notice and the turnaround time can range from 3 to 5 days.

The Reactor: If the 'responder' remains a suspect or is classified as a reactor on a secondary test, those animals will require euthanasia, necropsy, histopathology, +/- culture. Both the CCT and gamma interferon tests have occasionally resulted in false positives. If a TB case is confirmed, high priority will be placed on whole herd testing. Follow-up testing at six month intervals would be performed by State and Federal officials.

Avoiding problems in the TB testing process

1. When scheduling bovine TB testing, allow at least 2 to 3 weeks for any follow-up testing of suspects (Table 1). If a TB suspect is identified via the CFT, no animals will be allowed to leave the premise until herd status can be determined (movement restrictions include dairy bull calves). A common mistake is to have cattle transport trucks arrive at the conclusion of initial testing. This can be very costly and frustrating for producers if cattle are not permitted to be shipped because of a TB suspect.
2. Veterinarians should contact their regional WSDA or USDA field veterinarian as soon as TB testing is scheduled because confirmatory testing may be required. A list of WSDA field veterinarians, their regions, and contact information can be found at https://agr.wa.gov/departments/animals-livestock-and-pets/animal-health/contact-us.
3. Anticipate TB suspects when conducting herd testing. Indeed, accredited veterinarians conducting CFTs properly should have a 1-3% average suspect rate annually. Accredited veterinarians are at risk of losing their accreditation status with USDA if they fail to meet performance standards.

Test	Result	Action	Timeline	Veterinarian
Initial CFT	All negative	Ship cattle	3+ days after initial CFT	Private
Initial CFT	1+ suspects	1. Notify WSDA field veterinarian 2. CCT	ASAP after suspect identified Less than 10 days after initial CFT injection	Private WSDA/USDA field vets
Initial CFT	1+ suspect	1. Notify WSDA field veterinarian 2. Bovigam test	ASAP after suspect identified 3 to 30 days after initial CFT	Private WSDA field vet
CCT or Gamma interferon assay	Suspect or reactor or Two Positive gammas	Cull and necropsy at WSU WADDL; indemnity request to USDA	ASAP after identified	WSDA field vet
Whole Herd Test	Determine negative/positives	Test and Cull	6-month intervals until achieve negative status	WSDA/USDA field vets

Table 1. TB testing for cattle.

Requirements to export cattle to Canada: Canada requires negative CFT and Bovigam™ tests for certain classes of imported cattle. Check with the Canadian Food Inspection Agency for import requirements for breeding, rodeo, or feeder cattle. Contact the USDA before shipping cattle to Canada to check for rule changes and confirm correct procedures. USDA Tumwater contact info: 360-753-9430 and wa.export.animals@usda.gov

For veterinarians: collecting and shipping Bovigam™ **samples for Canada**

- For routine export to Canada when both CFT and Bovigam™ is required, the WSDA or USDA veterinarian in charge must approve the blood draw and lab submission.
- As a secondary test after a suspect CFT response, collect a 10 mL heparinized (green-top, sodium, or lithium) specimen of whole blood for a Bovigam™ test 3 to 30 days after the CFT.
- Specimens submitted in expired tubes will not be acceptable for official program purposes.
- Only submit blood from good clean draws. Clots or cell lysis can cause inconclusive results.
- Ice packs should not be in direct contact with samples. Put sufficient material between ice packs and samples to prevent samples from being damaged by freezing.
- The test must be submitted to the NVSL in Ames, IA.
- Samples must be drawn on Monday, Tuesday or Wednesday and shipped overnight to NVSL the same day. NVSL must be notified in advance.
- Use VS Form 10-4 for submissions. On the form, enter "gamma TB testing" in the EXAMINATIONS REQUESTED box.
- On the day of shipping, send the FedEx or UPS tracking number and scanned copies of form 10-4 and the overnight shipping label to Dr. Luci T. Dimick at Luci.T.Dimick@usda.gov.

Do you have questions? Please contact the Animal Health Program at (360) 902-1878, or your WSDA field veterinarian for further assistance.

Washington Animal Disease Diagnostic Laboratory (WADDL) Updates

By K Snekvik, Director of Operations, Pathologist & Aquatic Health Section Head

The Washington Animal Disease Diagnostic Laboratory (WADDL) has a weekly meeting (rounds) for the discussion of herd outbreak cases or diseases of concern. This meeting is unique in that it brings together specialists in veterinary diagnostic medicine, veterinary outreach, veterinary regulators, and researchers to solve and respond to diseases affecting our clients' herd and flock health. Some of the interesting discussions this quarter include:

Small Ruminant: Mortality event in goats exposed to toxic yew (*Taxus* spp.) plants. Forty of a group of 140 goats died from accidental exposure of the herd to trimmings from ornamental yew shrubs. Yew are popular evergreen shrubs that contain highly toxic alkaloids and the trimmings are accidently offered to livestock as an alternative feed source. All parts of the plant are toxic to animals and in this case a few of the plants were identified within the pasture with the goats. Yew leaves and intact twigs were identified in the rumen contents of a dead goat. Animals can present with muscle trembling, incoordination, difficulty breathing, convulsions, and often sudden death as in this case. In ruminants, there are reports that clinical signs can be delayed for up to 36 hours post-ingestion. The primary target organ is the heart. The diagnosis is typically made by evaluating the feed contents within the stomach of affected or dead animals during necropsy (autopsy). A toxic dose is as little as 0.1-0.5% of an animal's body weight. So, for an adult 150-pound goat, less than a quarter of a pound of plant material can be lethal. Of note, **the diagnostic work-up in the case presented to WADDL indicated that yew may be misidentified using common plant-identification mobile apps.** Although yew is generally not highly palatable to livestock, animals are more likely to graze on tender new growth or clippings discarded in a pasture so **uprooted bushes and clippings should never be placed near livestock.**

Poultry: Infectious laryngotracheitis (ILT) virus in multiple chicken flocks. There have been multiple outbreaks of ILT virus in backyard chicken flocks across Washington. This virus (*Gallid herpesvirus 1*) causes upper respiratory disease (coughing, gasping, mucoid exudate) and reduced productivity and death of infected chickens. Diagnoses of the cases at WADDL were confirmed by necropsy (autopsy), microscopic evaluation (histopathology) of the inflamed trachea and PCR detection of the virus in the affected trachea. Detection of ILT within your flock is reportable to the state veterinarian's office and the Avian Health Program at the Washington State Department Agriculture. ILT is transmitted from bird to bird or via contaminated clothing or footwear so keeping ILT virus out of your flock relies on good biosecurity measures and vaccination. For additional details regarding the etiology, epidemiology, pathobiology, and advances in diagnosis and control of ILT, check out this comprehensive review (Vet Q. 2020; 40(1): 140-161)

Public Health & Biosecurity: Over-the-counter Antimicrobials Coming Under Veterinary Oversight

By Dale A. Moore, Clinical Professor, Emeritus

Over the last decade or more we have discussed the increasing veterinary oversight of antimicrobial drugs. The first major change came in 2017 with the implementation of the Veterinary Feed Directive Rule. This next stage follows on the heels of California's law banning over-the-counter antimicrobials and the requirement of a Veterinary Client Patient Relationship and prescription, as well as antimicrobial stewardship education and antimicrobial use and resistance surveillance.

This new FDA guidance (#263) takes the 4% of antimicrobials used in veterinary medicine not currently under veterinary oversight and moves them to be administered only under veterinary supervision for the treatment, control or prevention of certain diseases. A veterinary consultation and prescription will be necessary for these drugs. This new guideline will be phased in over a two-year period and consists of a request by FDA that animal health companies voluntarily transition products from over-the-counter to prescription only. To provide a prescription to a livestock owner, the veterinarian and owner need to establish a Veterinary Client Patient relationship (VCPR) that is formalized and is best when in writing and reviewed at least annually. To establish a VCPR, the veterinarian needs to be familiar with the farm or ranch, how the animals are raised, the conditions seen and the capabilities of those responsible for animal care. However, a main concern of livestock owners is access to veterinarians in their rural environment.

Although the United States does not lack veterinarians, there are a number of challenges that impact whether veterinarians are willing to practice within rural areas. Financial constraints due to student loans, familiarity and comfort with rural settings, as well as work-life balance often dictate where veterinarians are willing to practice (Hashizume et al., 2015). Currently, within the U.S. there are about 500 counties in 44 states that are considered shortage areas.

In the U.S., a Veterinary Medicine Loan Repayment program exists to encourage rural practice, providing up to $75,000 in loan repayment. However, shortage areas must be identified and defined by the state veterinarian and interested candidates must apply. Despite the existence of this program, many shortage areas remain unfilled for years (Tack et al., 2018).

A Capital Press article in 2020 highlighted what some states are doing to address the lack of access to veterinarians in some rural areas. In addition to the federal loan repayment program, some states have instituted their own loan repayment programs. Ohio and Colorado are two of those states and Kansas State University has a Veterinary Training Program for Rural Kansas that includes loan forgiveness up to $80,000. An additional incentive is community support. Identifying and helping those students who might come back to the area is one idea and actively supporting the local veterinary practice is another. Some communities might even provide a business package to recruit a veterinary practice. Ultimately, the issue of access to veterinarians in order to obtain prescriptions for livestock in rural areas needs to be addressed now as the FDA Guidance phases in over the next two years.

References:

Hashizume et al. Changes in Veterinary Students' Attitudes Toward the Rural Environment and Rural Veterinary Practice: A Longitudinal Cohort Study. J Vet Med Educ. 2015; 42(2) https://doi.org/10.3138/jvme.1014-101R Tack et al. Exploration of veterinary shortages in the wake of the Veterinary Feed Directive. J Am Vet Med Assoc. 2018; 253:1334–1341. https://doi.org/10.2460/javma.253.10.1334

Establishing a veterinarian-client-patient relationship (AVMA)

A VCPR is present when all of the following requirements are met:

1. The veterinarian has assumed the responsibility for making clinical judgments regarding the health of the patient and the client has agreed to follow the veterinarians' instructions.
2. The veterinarian has sufficient knowledge of the patient to initiate at least a general or preliminary diagnosis of the medical condition of the patient. This means that the veterinarian is personally acquainted with the keeping and care of the patient by virtue of a timely examination of the patient by the veterinarian, or medically appropriate and timely visits by the veterinarian to the operation where the patient is managed.
3. The veterinarian is readily available for follow-up evaluation or has arranged for the following: veterinary emergency coverage, and continuing care and treatment.
4. The veterinarian provides oversight of treatment, compliance, and outcome.
5. Patient records are maintained.

Public Health & Biosecurity: FDA is Soliciting Comments on the Current Policy Regarding the Eligibility for Indexing of legally Marketed Unapproved New Animal Drugs for Minor Species

By WM Sischo, Food and Waterborne Disease Research & CS McConnel, Veterinary Medicine Extension

The FDA recently posted a proposal to define the use of "unapproved" drugs in minor species. FDA is looking for comments regarding allowing the use of drugs in minor species that had been considered food animals (their example is rabbits) although groups of those species may never actually enter the food supply (rabbits in laboratory settings). They are looking for comments that address whether this policy change both increases the availability of drugs for minor species and protects human and animal health. Minor species also include sheep and goats. Check out this link for additional information and guidance regarding the submission of electronic comments.

Organic Agriculture: The Iowa State University Livestock Project Supporting Organic/Alternative Animal Health

By CS McConnel, Veterinary Medicine Extension

The WSU CVM Field Disease Investigation Unit has strong links with the Iowa State University Center for Food Security & Public Health. The CFSPH group secured funding to develop The Livestock Project, an initiative supporting organic/alternative animal health. They are conducting a survey the results of which will help create tools and materials associated with the project. The survey takes about 10 minutes to complete and would benefit from your input if any of the following are true for your farm or ranch:

- USDA certified organic
- Organic but not certified
- In transition to certified organic
- Don't use any one or more of the following: antibiotics, synthetic anti-parasitic drugs, hormones, GMOs, vaccines, herbicides, pesticides in your animals or crops.
- Consider your livestock or poultry: 100% grass-fed, "natural", "free-range"
- Consider yourself non-conventional but don't see your farm or ranch type described above

This survey is anonymous and can be accessed via the following link: https://iastate.qualtrics.com/jfe/form/SV_8fbaiAWvRVFntcO

If you have any questions or concerns about the survey, please get in touch with Katie Steneroden at kksten@iastate.edu. She is more than happy to talk with you!

WSU CVM Senior Paper Highlights

Replacement heifer development, management, and selection decisions to increase the productivity and longevity of a beef herd

By Madison Comes (Advisor: Dr. George Barrington)

Summary: In a beef cattle operation, replacement heifers are the future of the herd. Producers hand pick replacement females and often invest heavily in feed, management, and breeding of these heifers. In order to be profitable, it is important that the replacement heifer crop reaches the desired body weight, becomes bred, carry a calf to term, calve dystocia free around two years of age and raise a healthy calf. The approach to heifer

development is multifaceted and starts as early as the weaning period. Proper nutrition is crucial for daily gain to ensure these females reach the desired percent of mature weight and are sexually mature and cycling at the time of breeding. Cyclicity can be evaluated on an individual level through reproductive tract scoring performed before the beginning of breeding season. Additional selection decisions can be made based on confirmation, frame size, and maternal genetics. By understanding these critical check points of heifer development, producers raise females that spend their lives returning on that initial investment by being high producing members of the herd. Placing emphasis on genetic selection, nutrition, pre-breeding reproduction tract scoring, breeding decisions, and pregnancy examination allows producers to increase heifer reproductive efficiency, female longevity, and monetary income for their operation.

Climate change and the physiologic drivers for the changing distributions of veterinary medicine's most important disease vectors

By Sadie Rath (Advisor: Dr. Steve Hines)

Summary: Relatively few things have remained untouched by climate change in the world today. Increasing global temperatures are inducing major shifts in our aquatic and terrestrial ecosystems and the organisms within them. In veterinary medicine, it may not always be obvious how climate change is affecting our profession. This paper seeks to examine the impact of climate change on some of the most significant disease vectors, mosquitoes and ticks, in the United States. Many of the pathogens these vectors transmit have not only veterinary importance, but zoonotic importance as well. Increasing temperatures in the United States are expected to cause expansions in vector range into northern latitudes and higher altitudes, as well as decrease suitable habitat in the southern United States. These changes are also putting pressure on vector species, selecting for those that have physiologic mutations that allow them to thrive in hotter, drier climates. Understanding these changes will be crucial in the coming years for veterinarians needing to implement preventative healthcare and client education for diseases that are expected to expand into new territories, like West Nile virus, Lyme disease, and canine heartworm.

Comparing caustic disbudding pastes: Pain-related behaviors, cost of use, and effectiveness

By Summer Ott (Advisor: Dr. John Wenz)

Summary: Disbudding calves is a common management practice in the dairy industry. There has been increasing consumer concern with this practice due to the associated pain. Recently there has been increased use of caustic paste disbudding which is perceived as less painful. The objective of this study was to compare Dr. Naylor (H.W Naylor Company, Inc., Morris, NY), a, a calcium hydroxide/sodium hydroxide-based product (DN, N=1342) with ReMOOV (Genex Cooperative, Shawano, WI), a calcium hydroxide/potassium hydroxide product (RM, N=1168). Time for farm personnel to apply each product was recorded in a subset of 382 calves per product. Pain-related behavior (count of head shakes, vocalizations, standing/lying transitions in 30 seconds) were observed by study personnel on another subset of 100 calves per product. Total cost of use was calculated per 100 calves based on labor and product cost. Efficacy was measured as the percentage of all enrolled calves requiring removal of at least one horn at 90 days of age. Average application time (seconds/calf) was shorter for DN (10) versus RM (13) (P<0.001). Total cost per 100 calves was greater for RM ($39.54) versus DN ($36.31), primarily due to higher product cost. Head shakes were substantially lower for RM (27%) versus DN (85%) (P<0.001). No difference in vocalizations were observed, however, transitions were substantially lower for RM (7.0%) versus DN (51%) (P<0.001). Calves requiring horn removal at 90 days of age was low overall but numerically higher for DN (0.9%) versus RM (0.3%) (P=0.129). These data suggest that even though ReMOOV is more expensive and takes slightly longer to apply, it is equally efficacious and substantially less painful immediately after application.

WSU Ag Animal Faculty Research Updates

1. Day 7 embryo quality and suboptimal uterine environment influence morphometry of Day 16 conceptus in dairy cows.

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Abstract: The objectives of this study were to investigate the effect of Day 7 embryo quality and subclinical endometritis (SCE) in repeat breeder recipient cows on morphometry of Day 16 embryo and to determine the association of %PMN, serum progesterone and Day 16 conceptus length. Holstein dairy cows that failed to conceive at least 3 times, (parity, 3 and 4; body condition score, 3 to 3.5 out of 5) with subclinical endometritis (n = 180; SCE, >6% PMN on endometrial cytology) or without subclinical endometritis (n = 180; No-SCE, ≤ 6% PMN) were selected. Cows in each group received single, frozen-thawed, quality 1 (n = 60), 2 (n = 60) and 3 (n = 60) embryos (compact morula or early blastocyst) on Day 7 post estrus in the uterine horn ipsilateral to the ovary containing a corpus luteum, using standard nonsurgical techniques. Only cows that expressed estrus (Select-Synch protocol) and with acceptable corpus luteum (≥1.5 cm in size) were included. Conceptuses were collected on Day 16 from all recipient cows by standard non-surgical uterine flushing technique, using an 18-g embryo collection catheter with Phosphate Buffered Saline (pH 7.4). Blood samples were collected on Day 16 to determine serum progesterone concentrations. After collection, conceptuses were weighed and measured, and were categorized as tubular (underdeveloped, 10-20 mm) or filamentous (normal, >25 mm). Between cows with SCE and No-SCE, mean (±SEM) width (1.68 ± 0.13 mm vs. 1.84 ± 0.16 mm), length (34.4 ± 9.6 mm vs. 55.8 ± 13.4 mm) and weight (22.3 ± 3.7 vs. 40.6 ± 6.4 mg) of Day 16 conceptuses differed (P < 0.05). The mean width (1.75 ± 0.19 mm vs. 1.81 ± 0.22 mm), length (57.7 ± 11.2 vs. 51.1 ± 13.6 mm) and weight (34.3 ± 6.4 vs. 38.5 ± 8.2 mg) of Day 16 embryo following transfer of Day 7 embryo quality grade 1 and grade 2 embryos were not different (P > 0.1), but both differed from the mean width (1.59 ± 0.11 mm), length (28.9 ± 9.7 mm) and weight (25.3 ± 4.6 mg) of Day 16 embryo from Day 7 embryo quality grade 3 (P < 0.05). Total percentage of embryos recovered differed between SCE and No-SCE groups (P < 0.05; 36.1 vs 48.9%). Total percentage of embryos recovered on Day 16 following transfer of grade 1 (53.3%) and 2 (44.2%) Day 7 embryos were greater (P < 0.05) compared with transfer of grade 3 embryos (29.2%) (P < 0.001). Total percentage of filamentous embryos recovered was lower for SCE cows compared with No-SCE cows (P < 0.01; 15.0 vs. 25.6%). Total percentage of tubular embryos recovered did not differ between SCE and No-SCE cows (P > 0.1; 21.1% vs. 22.8%). Filamentous embryo recovered for grade 3 was lower (P < 0.05) compared with grade 1 in both SCE (8.3 vs. 21.7%) and No-SCE groups (15.0 vs. 33.3%). The mean (±SEM) CL volume (cm3; 11.8 ± 0.29 vs. 15.9 ± 0.31) and progesterone concentrations (ng/mL; 5.17 ± 1.8 vs. 8.2 ± 1.2) on Day 16 differed between SCE and No-SCE groups (P < 0.05) but not among Day 7 embryo grade groups (P > 0.1). The mean (±SEM) CL volume (cm3; 15.6 ± 0.28 vs 12.1 ± 3.9) and serum progesterone concentrations (ng/mL; 8.6 ± 1.4 vs. 4.9 ± 1.9) on Day 16 differed (P < 0.05) between cows yielded filamentous and tubular embryos. When all cows were considered, multiple regression analysis showed that the %PMN (P < 0.0001), progesterone concentrations (P < 0.0001), embryo qulaity (P < 0.05) and %PMN by progesterone interactions (P < 0.0001) influenced the length of Day 16 conceptus. Among cows without subclinical endometritis, only progesterone concentrations (P < 0.0001) and among cows with subclinical endometritis, only %PMN (P < 0.04) influenced the length of Day 16 conceptus. Progesterone concentrations (P < 0.0001) influenced the length of Day 16 conceptus in cows that received embryo quality 1 and 2. Progesterone concentration by %PMN interaction (P < 0.05) also influenced the length of Day 16 conceptus in cows that received embryo quality 2. The %PMN (P = 0.05) influenced the length of Day 16 conceptus in cows that received embryo quality 3. In conclusion, poor quality Day 7 embryo and presence of SCE negatively influenced early embryo development between Days 7 and 16 of gestation probably by dysregulated embryo-maternal interactions due to lower progesterone, prompting loss of the conceptus in sub-optimal uterine environment.

2. Association of gastrointestinal parasite burden, serum cytokines and hormones concentrations, and pregnancy in Angus-cross beef cows

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Abstract: The objective was to elucidate the relationships among gastrointestinal (GI) parasite load, serum cytokines (Th 1 - Interleukin (IL) 2, Interferon (IFN) γ and Tumor necrosis factor (TNF) α; Th 2- IL4, IL6, and IL10) levels, hormones (progesterone, cortisol, 8-epi-prostaglandin F2 alpha (isoprostane), prolactin, substance-p, and prostaglandin F metabolites) concentrations, and pregnancy in beef cattle. Angus-cross beef cows (n = 700; age, 3-8 y) were blocked by age and body condition score (BCS, 1-9), and were randomly assigned to treatment (n = 350, TRT, 50 mg of eprinomectin/50 kg BW, im) or control (n = 350, CON, no treatment) on Day -30. Cows were synchronized using Controlled Internal Drug Release insert (CIDR) + CO-Synch protocol and artificially inseminated at a fixed time on Day 0 (66 h after CIDR removal). Fecal samples were collected to determine fecal egg count per gram (FEG, McMaster method) on Days -30, -23, -16, -7, 7, 0, 16 and 23, and blood samples were collected on Days -7, 0, 7, 16 and 23. Serum cytokines were determined on Days -7, 0, 7, 16 and 23, and circulating hormones were measured on Day 16. BCS were recorded on Day 16 following artificial insemination (AI), and pregnancy status was diagnosed on Day 30 and 60. Pregnancy/AI varied among treatment groups on Day 30 [TRT, 62.0% (217/350); CON, 54.9% (192/350) (P = 0.05)] and Day 60 [TRT, 60.9% (213/350); CON, 51.7% (181/350) (P < 0.05)]. Pregnancy loss between 30 and 60 days for TRT and CON groups were 1.8% (4/217) and 5.7% (11/192), respectively (P < 0.05). The BCS on Day 16 did not differ among treatment groups (P> 0.1). Four groups of 40 cows were selected based on their pregnancy status and treatment: pregnant, TRT; non-pregnant, TRT; pregnant, CON; and non-pregnant, CON to compare the mean FEG, cytokines, and hormones levels. The FEG and cytokine concentrations were significantly (P < 0.05) influenced by treatment, pregnancy status, day, treatment by pregnancy status, and treatment by day. Day 16 hormone concentrations were considerably influenced by treatment, pregnancy status, and treatment by pregnancy. Although FEG on Day -30 did not differ among the groups (P> 0.1), it was lower in treated, pregnant cows compared with cows in other three groups from Day -23 onwards (P < 0.05). Overall and pairwise comparisons showed that serum concentrations of Type 1 cytokines, IL2, IFNγ, and TNFα were lower (P < 0.05) from gestational Day 7 onwards in treated, pregnant cows compared with cows in other three groups. In contrast, serum concentrations of Type 2 cytokines, IL4, IL6 and IL10 were greater (P < 0.05) from gestational Day 7 onwards in treated, pregnant cows compared with cows in other groups. Serum concentrations of progesterone was greater and other hormones were lower for pregnant cows in TRT group compared to cows in other groups on gestational Day 16. In conclusion, GI parasite load was reduced; Th 1 cytokines levels were decreased; Th 2 cytokines concentrations were increased; progesterone level was increased; and cortisol, substance-P, prolactin, isoprostane, and PGFM were decreased in pregnant, TRT cows. These changes also resulted in an increase in P/AI. It is plausible that direct and bidirectional host-parasite interactions mediated by cytokines and hormones may have promoted maternal tolerance of an immunologically diverse conceptus and the establishment of pregnancy.

Continuing Education

Veterinarians

1. Academy of Dairy Veterinary Consultants Fall Meeting September 24-25, 2021. Albuquerque, NM. https://academyofdairyveterinaryconsultants.org
2. WSVMA Pacific NW Veterinary Conference October 1-3, 2021. Virtual event. https://pnwvc.wsvma.org
3. Fall CE Event October 30, 2021 from 9:00am-Noon. Hybrid event in Pullman, WA. Earn 3 CE Credits. Tracks include: Small Animal and Large Animal. https://cvme.vetmed.wsu.edu/

4. SAVE-THE-DATE: CVM Spring Conference March 25-27, 2022. Earn 1 FREE credit hour by attending Friday's Bustad Lecture and 12 CE credits by attending Saturday and Sunday lectures. Tracks include: Ag Animal, Equine, Small Animal and Technician. https://cvme.vetmed.wsu.edu/

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