1165 The effects of nutritional restriction on endogenous retroviruses and placentation during the first 50 d of gestation in beef heifers.
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The objectives of this study were to evaluate the effects of maternal nutrient restriction and day of gestation on mRNA expression of *syncytin-Rum1*, bovine endogenous retrovirus K1 (*BERV-K1*), interferon-tau (*INF-τ*), and pregnancy specific protein B (*PSP-B*). At breeding (0 d), crossbred heifers ($n = 49$; ~15 mo of age; initial BW = 324.9 kg) were assigned to dietary treatments, control (fed to gain 0.45 kg/d BW gain) or restricted (60% of control). Heifers were ovariohysterectomized at d 16, 34, or 50 resulting in a 2 × 3 factorial. Non-bred, non-pregnant heifers ($n = 6$; NP), on the control diet, were ovariohysterectomized as baseline controls on d 16 of the estrous cycle. The tissues collected consisted of pregnant horn caruncle (P-CAR), pregnant horn inter-caruncle (P-ICAR), non-pregnant horn caruncle (NP-CAR), non-pregnant horn inter-caruncle (NP-ICAR), and fetal membrane (chorioallantoic; FM). Relative gene expression was calculated using the delta delta Ct method with β-actin as the reference gene and NP as the control tissue. Data were analyzed using PROC GLM of SAS with the model including d of gestation, nutritional treatment, and their interaction. There was significant d of gestation × nutrition interaction for expression of *BERV-K1* in NP-CAR and *INF-τ* in FM while all other interactions were not significant ($P > 0.08$). Expression of *INF-τ* was influenced by d of gestation and nutritional treatment in FM, with d 16 restricted being greatest (5781 fold; $P < 0.01$) followed by d 16 control FM (3324 fold); the remaining d and treatments were not different. In FM, *BERV-K1* was greatest ($P < 0.01$) on d 34 (2961 fold) compared with d 16 and 50 (5 and 1861 fold, respectively). *Syncytin-Rum1* increased ($P = 0.04$) in FM throughout the first 50 d (375 fold) of gestation. *Syncytin-Rum1* expression in P-ICAR was greatest ($P = 0.01$) at d 16; however, *syncytin-Rum1* expression in P-CAR tended ($P = 0.09$) to be greater at d 50. Expression of *PSP-B* increased ($P < 0.01$) throughout early gestation until d 50 in both NP-CAR (316 fold) and P-CAR (18,215 fold). Although nutritional restriction did not influence endogenous retrovirus expression in maternal or fetal tissues, it did influence *INF-τ* expression. These data suggest that both BERV-K1 and syncytin-Rum1 may interact with PSP-B during the establishment of the feto-maternal interface and syncytial plaques.

Key Words: beef heifers, early gestation, endogenous retroviruses, nutrient restriction

PHYSIOLOGY, ENDOCRINOLOGY, AND EXTENSION SYMPOSIUM: ENHANCING ADOPTION OF REPRODUCTIVE MANAGEMENT TOOLS FOR BEEF AND DAIRY PRODUCERS

1166 History of the development of the Beef Reproduction Task Force (BRTF) and impacts of the BRTF on beef cattle reproductive management.
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The Beef Reproduction Task Force (BRTF) was formed during a period of evolving science that resulted in systems to allow producer-acceptable results with a single fixed-timed insemination. The group organized and developed goals to enhance productivity and profitability of U.S. beef herds by integrating research and extension efforts with the intent of more effectively transferring the use of reproductive technologies to the field. A key early step was to coordinate efforts in identifying effective breeding management protocols for beef cattle and to clarify their associated acronyms. A short-list of recommended protocols and their acronyms for synchronization of estrus and ovulation in beef cattle was developed based on results from peer-reviewed, published research and a comprehensive review of data collected from the field. The list of recommended protocols was developed by the BRTF in cooperation with veterinarians and representatives from associated industries. The synergies of this larger industry-centered working group have resulted in ideas for research and broader educational reach. Together the group has planned and hosted 17 in-depth meetings at locations in key cow-calf areas across the country since 2002. These "Applied Reproductive Strategies in Beef Cattle" workshops targeted beef producers, AI industry personnel, veterinarians, allied industry representatives, and academicians. A national media sponsor has provided online coverage of the meetings (www.appliedreprostrategies.com) since 2008. The effectiveness of the team was recognized with the NIFA Partnership Award for

Multistate Efforts in 2013. A 2013 national survey of AI users indicated 97% of respondents (n = 425) were familiar with the BRTF recommended protocol lists. Recommendations from these guidelines were generally used by 65% and sometimes or occasionally used by 20% of respondents. Resources developed by the group include the Estrus Synchronization Planner in a mobile and spreadsheet version, tools to evaluate cost differences of AI and natural service breeding and numerous publications and support materials on a beefrepro.info website. The group has set in place a plan to bring in new members to help address changing industry needs. The multi-state research and extension effort combined with the industry group's insight and support have provided valuable information in a growing beef AI industry.

Key Words: artificial insemination, beef, synchronization of estrus

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1167 History of the development of the Dairy Cattle Reproduction Council (DCRC) and impacts of the DCRC on dairy cattle reproductive management.

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The DCRC was founded in 2006 in response to a decline in lactating dairy cow fertility that was occurring worldwide. The initial founders included academicians, allied industry professionals, veterinarians, and producers. The established goals of the organization are to educate and provide support for the development and implementation of new technologies that will sustain and improve reproduction in dairy cows and heifers. The organization is guided by a series of principles that were established by its founding members, the most important of which was to be science-based and non-commercial. The group is inclusive and seeks to involve all individuals with an interest in dairy reproduction. A professional and discounted student membership is offered. Members have full access to past proceedings and newsletters. Officers, directors, and committee members of the DCRC serve on a voluntary basis. There are four primary mechanisms through which the DCRC achieves its stated goals. First, a meeting is held annually that includes invited presentations on relevant topics. An invited poster session is also held during the meeting. The meeting is moved to different locations within the United States to facilitate participation by individuals from different dairy regions. Second, an awards competition is sponsored that identifies and recognizes dairy herds with the best reproduction by using objective criteria. Awardees are invited to participate in the annual meeting and are also recognized in trade magazines. Third, resource materials are prepared that include protocol sheets with diagrams of reproductive protocols for both dairy cows and heifers. The protocols depicted on the sheets are vetted annually by a committee so that the information is current and based on the most-recent scientific findings. The protocol sheets are printed in both English and Spanish languages. Finally an electronic newsletter is published six times each year that includes a president's message, research summaries, technical information, a member profile, and a meeting calendar. The 2015 meeting held in Buffalo, NY was the largest meeting to date. The continued growth of the DCRC and recognized improvements in dairy reproduction in the past 10 yr speak to the success of the organization.

Key Words: cow, dairy, fertility

1168 Physiological and management advances enhancing adoption of applied reproductive management procedures in beef cattle.

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Advances in research over the past two decades expanded our understanding of the bovine estrous cycle and led to improvements in methods to more effectively control estrus and ovulation in beef heifers and cows. Precise monitoring of ovarian follicles and corpora lutea over time by transrectal ultrasonography expanded our understanding of the changes that occur during a follicular wave. Consequently, we now know that precise control of estrous cycles requires the manipulation of both follicular waves and luteal lifespan. As a result, breeding management technologies are currently available or emerging that offer the potential to more effectively manage reproduction, expedite genetic progress, enhance efficiencies of production, and add value to beef cattle produced and marketed in the U.S. Until recently, the inability to predict time of estrus for individual cows or heifers in a herd was the primary reason beef producers viewed AI as being impractical to use because of the labor required to detect estrus. However, improvements in methods to control estrus and ovulation in beef heifers and cows provide the opportunity to expand the use of AI by reducing the period of time required to detect estrus or eliminate estrus detection entirely. Protocols for inducing and synchronizing a fertile estrus in which progestins are used strategically with gonadotropin releasing hormone and prostaglandin F2α provide opportunities for beef producers to synchronize estrus and ovulation and facilitate fixed-time AI. Procedures used to control estrous cycles in cattle include synchronization of estrus and ovulation in estrous cycling females, and induction of estrus accompanied by fertile ovulation in heifers that have not yet reached puberty or among cows that have not

returned to estrus after calving. These strategies provide opportunities for producers to utilize sires of elite genetic merit, reduce length of the breeding and calving seasons, produce more uniform calf crops, and improve reproductive rates of replacement beef heifers and the mature cow herd. Collectively, advancements in applied reproductive technologies afford beef producers the flexibility to match specific breeding management protocols to a defined management system, thereby creating the opportunity to significantly expand use of AI in beef herds across the United States and enhance profitability of the beef enterprise.

Key Words: beef, estrus synchronization, fixed-time AI

1169 Physiological and management advances enhancing adoption of applied reproductive management procedures in dairy cattle.

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Since the first meeting of the Dairy Cattle Reproduction Council in 2006, several advances occurred to upgrade reproductive management programs in dairy herds. Many advancements are refinements of the currently applied standard 7-d Ovsynch program (GnRH [d 0; G1]; $PGF_{2\alpha}$ [1 dose on d 7]; GnRH [G2; d 9.5]; and AI 16 h after G2). Key advances: (1) including GnRH in presynchronization programs to facilitate ovulation before first or repeat AI to change the proportion of cows with a corpus luteum (CL) and more moderate progesterone concentrations to start Ovsynch, thus increasing G1-induced LH release and subsequent ovulation to G1 and greater pregnancy per AI (P/AI). (2) Clarifying the specific role of progesterone in targeted sub-fertile populations before first or repeat AI of cows without a CL to facilitate greater P/AI compared with non-progesterone treated controls without a CL, but similar P/AI to cows starting Ovsynch in diestrus. (3) Applying increased dosages or additional injections of $PGF_{2\alpha}$ to enhance luteolysis before timed AI to increase P/AI in cows treated with either the 5- or 7-d Ovsynch program. (4) Increasing dosages of GnRH at G1 or G2 to increase ovulation incidence did not always increase P/AI. (5) Diagnosing pregnancy via blood or milk pregnancy-associated glycoprotein (PAG) tests beginning 28 d post-AI to spare veterinarians' time to address other health issues. (6) Field testing the role of a 5- or 7-d Ovsynch program with progesterone inserts to facilitate timed AI in dairy heifers to increase early pregnancy in replacement heifer programs and reduce days on feed before first calving. (7) Incorporating gender-selected semen in AI programs to increase herd size from within, allow for more selective culling, and less outsourced heifer purchases. (8) Applying software tools to project revenues and costs associated with various timed AI and estrus-detection AI programs. (9) Detecting ovarian structures to more accurately diagnose large anovulatory follicles or ovarian cysts, early pregnancy, and subsequent embryo survival via diagnostic transrectal ultrasonography. (10) Applying technologies such as activity monitors to assess increased physical activity associated with estrus, monitor rumination and ear temperature, and RFID for accurate cow identification. (11) Clarifying the role of postpartum health (clinical and subclinical disease) on subsequent P/AI. (12) Applying genomics and fertility-selection traits to enhance fertility. These physiological advances have impacted reproductive management, increased P/AI, and promoted sustainability of dairy herds to provide dairy products to feed a hungry world.

Key Words: dairy, fertility, management

1170 Impacts of temperament on reproductive performance of *Bos indicus* and *B. taurus* beef females.

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Temperament is defined as the fear-related behavioral responses of cattle when exposed to human handling. Our group evaluates cattle temperament using: 1) chute score; 1 to 5 scale that increases according to excitable behavior during restraint in a squeeze chute, 2) exit velocity; speed of an animal exiting the squeeze chute, 3) exit score; dividing cattle according to exit velocity into quintiles using a 1 to 5 scale (1 = cattle in the slowest quintile; 5 = cattle in the fastest quintile), and 4) temperament score; average of chute and exit scores. Subsequently, cattle are assigned a temperament type; adequate temperament (ADQ; temperament score ≤ 3) or excitable temperament (EXC; temperament score > 3). To assess the impacts of temperament on reproductive efficiency in beef production systems, our group associated these evaluation criteria with puberty attainment and pregnancy rates in *Bos taurus* and *B. indicus*-influenced females. Cattle classified as EXC had greater plasma cortisol vs. ADQ cattle during handling, independent of breed type (*B. indicus* × *B. taurus*, $P < 0.01$; *B. taurus*, $P < 0.01$; *B. indicus,* $P = 0.04$) or age (cows, $P < 0.01$; heifers, $P < 0.01$). In regards to reproductive variables, *B. taurus* and *B. indicus* × *B. taurus* EXC heifers reached puberty at older ages ($P < 0.05$) compared with ADQ cohorts. Cows classified as EXC had reduced annual pregnancy rates vs. ADQ cows across breed types (*B. taurus*, $P = 0.03$; *B. indicus* × *B. taurus,* $P = 0.04$; *B. indicus*, $P = 0.05$). Moreover, *B. taurus* EXC cows also had decreased calving rate ($P = 0.04$), weaning rate ($P = 0.09$), and kg of calf weaned/cow exposed to breeding ($P = 0.08$) vs. ADQ cohorts. Our group also reported that acclimating *B. indicus* × *B. taurus*or *B. taurus* heifers to human handling improved temperament ($P \leq 0.02$), reduced plasma cortisol ($P < 0.01$), and hastened puberty attainment ($P \leq 0.02$). Hence, strategies to improve herd temperament, including selection for this trait and acclimation of young animals to human handling, are imperative for optimal reproductive efficiency of beef operations based on *B. taurus* and *B. indicus* influenced cattle.

Key Words: beef cattle, reproduction, temperament

1171 Estrus: Association with productive parameters and implications to fertility. R. L. A. Cerri*[1], B. F. Silper[1], T. A. Burnett[1], A. M. L. Madureira[2], J. L. M. Vasconcelos[2], and L. Polsky[1], [1]*Applied Animal Biology, Faculty of Land and Food Systems, University of British Columbia, Vancouver, Canada,* [2]*Sao Paulo State University, Botucatu, Brazil.*

Comparison between the fertility of timed-AI protocols vs. AI based on spontaneous or induced estrus is often inadequate. Day post-partum at AI and the consequent grouping of animals with different cyclic status, BCS, and overall health status is a confounding factor caused by many experimental designs. Previous studies observing the effect of concentration of progesterone during diestrus, concentration of estradiol and length of proestrus and follicular dominance minimize or neglect the effect of the expression of estrus on parameters such as fertilization rate, embryo quality, and endometrium receptivity. In one study, the likelihood of ovulation was greater for high vs. low relative increase estrus, but a more detailed experiment also showed slight differences in the timing of ovulation. Expression of estrus near AI also modified the expression of genes related with the immune system, adhesion molecules and prostaglandin synthesis in the endometrium (*MX1*, *MX2*, *MYL12A*, *MMP19*, *CXCL10*, *IGLL1*, *SLPI, OTR*, and *COX-2*) and those related with apoptosis, P4 synthesis, and prostaglandin receptor (*CYP11A*, *BAX*, and *FPr*) in the CL. The expression of estrus was associated with increased P/AI for timed-AI (38.9 vs. 25.5%) and embryo transfer (46.2 vs. 32.7%) protocols. Moreover, there was a decrease in pregnancy loss in both programs. Data from other recent studies involving spontaneous and estradiol cypionate induced estrus have shown that greater relative increase and longer duration of estrus, captured by different activity monitors, have a significant impact on P/AI (over 12% points across different studies). Intensity and duration of estrus were correlated with BCS, parity, and secondary behavior signs as expected, but only weakly associated with milk production. Follicle diameter and concentration of estradiol at estrus were also weakly correlated with estrus expression. Collectively, ovulation could partly explain the observed reduction in fertility, but it is clear that the endometrium and the CL play an important role that is independent of parameters such as parity, BCS, and milk production. Quantitative information from estrus events could be used to improve estrus detection quality and develop decision-making strategies at the farm level. Further studies in this field should aim to 1) better understand ovarian, embryo and endometrium mechanisms associated with either the expression or intensity of estrus and, 2) refine the collection of phenotypes related to estrus (i.e., relative increase, absolute increase, baseline levels, duration, and repeatability within cow) to improve estrus detection and possibly genetic selection.

Key Words: dairy cow, estrus expression, fertility

PRODUCTION, MANAGEMENT, AND ENVIRONMENT

1172 Use of evaporative cooling systems and their effects on core body temperature and lying times in lactating dairy cattle. J. R. Johnson*[1], L. G. D. Mendonça[2], J. P. Harner[3], and M. J. Brouk[1], [1]*Department of Animal Sciences and Industry, Kansas State University, Manhattan,* [2]*Kansas State University, Manhattan,* [3]*Department of Biological and Agricultural Engineering, Kansas State University, Manhattan.*

A study was completed to assess the effect of an evaporative cooling system on respiration rates, rear udder skin temperature (T_u), core body temperature (CBT), and resting time in lactating dairy cows. There were two environmental treatments in this study: FAN (Cyclone fans only, no fog); and FANFOG (Cyclone fans and fog on). Cows exposed to these 2 environments were either housed in a bedded pack barn equipped with an evaporative cooling system (Cyclone fans, Chippewa Falls, WI) or a tie-stall barn equipped with cooling cells. Cows were divided into 2 treatment groups with 8 cows/treatment: TIE which spent 50% of the time in the tie-stall barn and 50% of the time in the bedded pack barn, and PACK which also spent 50% of the time in the tie-stall barn and 50% of the time in the bedded pack barn but opposite of TIE. Each cow was fitted with a vaginal temperature logger (HOBO U12, Onset Computer Corporation, Pocasset, MA), a neck collar that contained a sensor (HOBO Pro V2, Onset Computer Corporation, Pocasset, MA) to track temperature and relative humidity of the environment, and an electronic data logger (HOBO Pendant G Acceleration Data Logger, Onset Computer Corporation, Pocasset, MA) to track lying times. Ambient temperature and relative humidity (RH) were also collected and all devices recorded at 1 min intervals. During FANFOG, PACK cows had reduced ($P < 0.05$) respiration rates (breaths per minute) compared with TIE (69 vs. 76 ± 2.4 BPM). Breaths per minute also increased significantly throughout the day for TIE but this was not the case for PACK. No differences were found in T_u between treatments. CBT data were divided into the following categories: < 38.6°C, ≥ 38.6°C, and ≥ 39.0°C. When exposed to the FANFOG environment, cows spent decreased ($P = 0.05$) time above 39°C CBT when compared with FAN (9.2 vs. 14.6 h/d, respectively), while PACK cows during FAN and FANFOG spent fewer hours/day above 39°C CBT vs. TIE ($P < 0.05$). TIE showed numerically greater total daily lying times during FAN and FANFOG compared with PACK ($P > 0.10$). These results confirm that evaporative cooling systems (Cyclone fans and fog) are effective at decreasing respiration rates and CBT thus improving cow comfort, while having no