Animal Behavior and Well-Being: Focus on Affective State

266 Behavioral approaches to assess and improve affective state of dairy cattle. E. K. Miller-Cushion1, and J. M. C. Van Os2, 1University of Florida, Gainesville, FL, 2University of Wisconsin, Madison, WI.

A central issue in the study of animal welfare is how and when animals suffer. Understanding and alleviating poor welfare states, and providing resources that allow for positive experiences, may be considered an ethical imperative. Approaches to understanding affective state have often focused on behavioral changes associated with adverse or challenging events. For example, changes in time budgets (e.g., feeding, activity, play, and social behavior) have been observed in calves around disbudding and during illness. Body posture, movement of specific body parts, and pain-face or grimace scales are also increasingly studied. Preference and motivation tests can tell us how animals perceive and value different resources and opportunities for behavioral expression, which is informative for managing animals to improve affective state. For example, animals are motivated to access resources which may alleviate negative states, such as shade in hot conditions. This can be assessed through short-term tests or by observing behavior and resource use over longer periods in normal housing. Other short-term tests can offer insights into an animal’s pervasive affective state (e.g., cognitive bias tests) or perception of stimuli as positive or negative (e.g., aversion races or conditioned place preference tests). Our ability to gain insight into an animal’s subjective experience remains subject to some limitations. Behavioral observation and testing often provide insight into only the valence (positive vs. negative) of emotions, which is important for welfare assessment but may not inform how to improve animal welfare. Further, whereas responses associated with perceived negative states have been well studied, we have limited means to evaluate positive states. Monitoring individual responses and understanding the scope of individual wants and needs also remains a challenge. Nonetheless, increasing use of automated technology and continuing study in this area, including recognition of how behavior patterns may be reflective of personality and individual ability to cope and respond to changes, is shedding new light on our understanding of animal emotions.

Key Words: affective state, emotion, behavior

267 Hock injury healing through facility transitions on dairy cattle in Canada. A. M. Armstrong*, J. Schenkels2, T. F. Duffield3, D. B. Haley1, and D. F. Kelton1, 1University of Guelph, Guelph, ON, Canada, 2Atlantic Veterinary College, Charlottetown, PEI, Canada.

Hock injuries are prevalent across the dairy industry, with recent benchmarking in North America showing that cows managed in intensive systems are at a higher risk for injury development. It is unknown which hock injuries heal based on descriptions of severity and complexity, and how long the healing process takes. The objective of this observational study was to determine if hock injuries heal or improve over time through facility transitions into more ‘cow friendly’ housing environments, and how long this healing process takes. Fifteen commercial dairy farms were enrolled, 5 in Ontario and 10 in Nova Scotia based on housing type and transitions made on the farm. The transitions were to facilities with mattresses, sand, pack or pasture cow resting areas. Mattresses were considered the least ‘hock friendly’. A total of 682 cows were assessed for the presence of hock injuries using the Canadian proAction Animal Care Assessment scoring system. Hock injuries with scores of 0 or 1 on the 4-point scale are deemed acceptable, and scores of 2–3 are unacceptable, and require corrective action. Cows were scored for 14-weeks in their new environment. The preliminary results are from the 10 farms, and 292 cows assessed in NS. Eighty-one cows that started their facility transition with a hock injury score that required corrective action met the inclusion criterion and were included in the survival analysis for time to healing. The analyses were completed using Stata/SE 15.0, with a significance level of $P = 0.10$ for the preliminary analysis. A Cox proportional hazards model was fit for hock injury healing with stall base as the predictor. Hock injuries healed 6.00 times faster on sand ($P = 0.001$, 95% CI: 2.04–17.7), 3.08 times faster on packs ($P = 0.096$, 95%CI: 0.82–11.6), and 5.81 times faster on pasture ($P = 0.001$, 95%CI: 2.08–16.6) compared with mattresses. Based on the preliminary results, hock injuries are more likely to heal, and heal faster when cows transition to more cow ideal housing conditions. These results will provide the dairy industry with information on what housing environments are best for resolution of injuries to occur, as well as a timeline for resolution.

Key Words: hock injury, healing, welfare

268 A survey of dairy cattle veterinarians’ perspectives on timely management and euthanasia for common calf conditions. M. C. Cramer*, A. M. Dietsch1, J. K. Shearer2, K. L. Proudfoot1, and M. D. Pairs-García1, 1The Ohio State University, Columbus, OH, 2Iowa State University, Ames, IA.

Despite high morbidity and mortality in dairy calves, few scientific guidelines exist for timely treatment and euthanasia. The objectives of this study were to determine dairy veterinarians’ (n = 49) perspectives on euthanasia decisions in response to common calf conditions (n = 9) and to assess preferred timelines for euthanasia for each condition. We requested veterinarians complete an online survey using an email invitation sent to the American Association of Bovine Practitioners listserve. Responses to management decisions for calf conditions included: “euthanize immediately,” “treat and monitor for signs of improvement,” “cull/sell for beef,” or “n/a.” If veterinarians selected “treat and monitor,” a follow-up question was asked: “how many days are you willing to give the animal to improve until you decide that euthanasia is the best option?” The proportion of respondents that selected each option was determined using PROC FREQ in SAS. The only condition that most veterinarians selected “euthanize immediately” was if the calf was identified as non-ambulatory (53%; 23/49). “Treat and monitor for signs of improvement” was the most common response for all other conditions: bloat (97%; 48/49), diarrhea (100%; 49/49), joint infection (95%; 36/49), severe lameness (79%; 30/49), navel infection (100%; 49/49), nervous system disorders (82%; 31/49), pneumonia (97%; 37/49), and traumatic injury (71%; 27/49). The number of days reported (median, range) until euthanasia was deemed the best option were as follows: bloat (n = 26; 3, 1–14), diarrhea (n = 26; 7, 2–14), joint infection (n = 1; 5), severe lameness (n = 17; 5, 1–10), nervous system disorders (n = 23; 3, 1–7), non-ambulatory (n = 16; 2.5, 1–7), pneumonia (n = 24; 5, 1–14), and traumatic injury (n = 17; 3, 1–7). Veterinarians generally agreed upon management decisions for all conditions. However, the wide range of responses for euthanasia timelines make it difficult to establish recommendations for the industry. Our next step to understand veterinarian decision-making is to determine what drives the wide variation in responses regarding euthanasia decision-making.

Key Words: health, welfare
269 Effect of stocking density and a barrier in a group close-up pen on the odds that dairy cows develop metritis after calving, K. Creutzinger*, L. Dann, L. Moraes, P. Krawczel, and K. Proudfoot, 1The Ohio State University, Columbus, OH, 2William H. Miner Agricultural Research Institute, Chazy, NY, 3University of Tennessee, Knoxville, TN.

A high number of dairy cows succumb to disease after calving, and the risk of disease may be affected by the social environment before calving. The objective of this study was to determine the effect of stocking density and the provision of a barrier in group close-up pens on the likelihood that cows developed metritis after calving. A total of 319 Holstein dairy cows (primiparous = 113, multiparous = 206) that were part of a larger experiment were included in the study. Pens were dynamic as cows moved in at 21 ± 3 d before their expected calving date and remained immediately after calving. At enrollment, cows were assigned randomly to one of 4 treatments using a 2 × 2 factorial arrangement including 1) high vs. low stocking density (9.7 to 12.9 m² vs. 19.4 to 25.8 m² lying space /cow), and 2) presence of a barrier (yes vs. no). The barrier was created using 2 road Jersey barriers and plywood (3.6 × 0.6 × 1.5 m). Pens were created using gates separating 4 areas within a large sawdust bedded pack and were replicated 4 times at 4 different periods so that all treatments were in all positions in the larger pack. Vaginal discharge was scored on 3, 7, 10, 14 d after calving with a Metrichec check to diagnose subclinical and clinical metritis. Data describing metritis (healthy, subclinical and clinical) were analyzed with a multinomial proportional odds mixed model. Random effects for period, pen and pen × period × treatment were included in the model. Fixed effects describing the factorial arrangement of treatments as well as parity, calving assistance, and retained placenta were included in the model. Calving assistance (OR = 3.9; P < 0.0001) and retained placenta (OR = 6.4; P < 0.0001) significantly increased the odds of metritis severity. Stocking density (OR = 1.6; P > 0.05) and the presence of barrier (OR = 1.3; P > 0.05) did not affect the odds of developing metritis. No significant interactions were detected. Results suggest that moderate increases in stocking density and provision of a physical barrier in a group bedded-pack for close-up cows did not affect the odds of developing metritis after calving.

Key Words: stocking density, transition

270 Housing tie-stall dairy cows in deep-bedded loose-pens during the dry period has the potential to improve gait. E. Shepley* and E. Vasseur, McGill University, Ste-Anne-de-Bellevue, QC, Canada.

Increasing locomotor activity can improve leg health and decrease the prevalence of lameness in dairy cows. The dry period offers an opportunity to provide alternative housing to tie-stall cows that can increase locomotor activity. Our objective was to determine if housing tie-stall dairy cows in a deep-bedded loose pen during the 8-week dry period affected gait and step activity. Twenty cows, paired by parity and calving date, were assigned at dry-off to a deep-bedded loose-pen (LP) or a tie-stall (TS). Step activity was measured by leg-mounted pedometers. Cows were walked 1x/wk on a test corridor and video recordings of gait were taken. Six aspects of gait were scored on a 0–5 scale (interval: 0.1): tracking up, joint flexion, back arch, asymmetric step, swing, and reluctance to bear weight. Overall gait was also scored using a 1–5 scale (interval: 0.5). Data for gait was analyzed based on the change in gait between the dry-off and calving. Daily step data were averaged per week of the dry period. Analyses were performed using a using a mixed model with treatment, week, and pair as fixed effects and cow nested within treatment and pair as a random effect for step data. The same model, omitting the fixed effect of week, was used for gait. There was no difference in step activity between LP and TS cows (842.1 ± 88.86 vs 799.5 ± 76.92 steps/d, LP vs TS, respectively; P = 0.73). Only joint flexion yielded a treatment difference with LP cows improving over time and TS cows worsening (−0.4 ± 0.15 vs +0.2 ± 0.16; P < 0.05). Although step activity was similar in both housing options, the increased space allowance in the LP treatment may have allowed for a larger range of motion for each steps, increasing the overall benefits to leg health. The denser lying surface in the LP may also have provided a cushioning effect when transitioning between rising and lying, improving joint health and, thus, joint flexion. Providing tie-stall cows with alternative housing during the dry period has the potential to help cows to recover their health in preparation for their next lactation.

Key Words: dry cow, gait, housing

271 Association between feeding behavior and wellness scores in Jersey dairy cows around calving. D. du Toit*, G. Esposito, J. H. van Zyl, and E. Raffrenato, Department of Animal Sciences, Stellenbosch University, Stellenbosch, South Africa.

Triaxial accelerometers have been validated, to measure behavior, mainly in Holstein-Friesian (HF). Our objective was to investigate feeding behavior of transition Jersey cows and its interaction with wellness scores, using a commercial triaxial accelerometer. Jersey cows (n = 145) were fitted with the Silent Herdsman neck collar (Afmilk, Israel) which recorded eating and rumination time hourly from −21 to 21 DIM. Rumen fill, fecal, lameness, leg hygiene and body condition scores (BCS) were assigned every 2 d. Afmilk (Israel) provided feeding behavior data before algorithmic transformation. Pearson correlations evaluated associations between collar data and scores. Feeding behavior was also analyzed with the GLIMMIX procedure of SAS, with cow and DIM as random and repeated variables, respectively. Animals belonging to the specific score value, parity, DIM and the respective interactions were included as fixed factors. BCS was included as a continuous variable. Feeding and rumination times were positively correlated (0.34 to 0.55; P < 0.01) with fill score and BCS, and negatively correlated with leg hygiene and lameness scores (−0.32 to −0.12; P < 0.01). Parity did not affect daily rumination time, but older cows ruminated more (P < 0.001) around parturition. DIM was significant (P < 0.0001) resulting in cows reducing rumination time from 423 ± 52 min at DIM −21 to 197 ± 8 min at calving. Only after 20 d postpartum, cows ruminated at least 400 min/day. Higher lameness scores were associated with reduced rumination (P < 0.0001), decreasing of 1 h from score 1 to 4. When including eating time as response variable, younger cows spent more time at the manger (599 ± 32 vs. 538 ± 30 min; P < 0.0001). DIM affected eating time, mainly due to a drastic reduction of eating time after calving, from 635 ± 33 min, of the −21 DIM, to 542 ± 10 min for the first 10 DIM. Lameness resulted in a drastic reduction of time spent eating from 583 min, for score 1, to 512 min, for score 4. These data proved to be different from what reported for HF suggesting that accelerometers might need to have Jersey cows-specific algorithms and that, relatively to the scores analyzed, at least locomotion will affect feeding behavior and may be detected early.

Key Words: accelerometer, precision farming, transition cow

Mastitis and lameness are 2 of the most prevalent diseases on dairy farms and increase culling risk while negatively affecting cow welfare and milk production. Identifying critical points on the lactation curve, where the first incidence of mastitis or lameness has the biggest impact on milk production, is a strategy to improve lifetime profitability and is a useful tool to help farmers make informed decisions. The aim of this study was to analyze the impact of the first incidence of mastitis or lameness on total milk production at different stages of lactation. Data were retrieved from Valacta’s database from first parity Holstein cows that calved between 2000 and 2015. After editing to ensure complete health records, the final data set consisted of 14,025 health records from 103 herds, yielding 1770 first mastitis events and 1063 first lameness events, with the remainder of records representing cows with no recorded health event (Control). First event records were grouped into transitional (1–21DIM), early (22–100DIM), mid (101–200DIM) and late (201+DIM) lactation stages to account for the most critical points of the lactation curve. Mid and late lactation cows were stratified by cumulative milk yield before the mastitis or lameness event to account for production level. Data were analyzed in a mixed model with herd as the random effect. Control cows produced 588 ± 115.6, 412 ± 130.3 and 420 ± 143.6 (P < 0.001) kg/lactation more milk than cows with the first mastitis event in transition, early and mid stage of lactation, respectively. Control cows produced 1331 ± 206.4, 803 ± 142, and 2052 ± 36.6 (P < 0.001) kg milk/lactation more than cows with a lameness event in transition, early and mid stage of lactation, respectively. Cows that reported a first case of mastitis or lameness in the late period showed no difference with the control group. These results allowed identifying long-lasting effects of mastitis and lameness on the total milk production, and therefore, could be used by farmers to make informed culling decisions to maximize both herd profitability and cow longevity.

**Key Words:** lifetime profitability, cow longevity, decision making

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273  **Condition of cull dairy cows from farm to slaughter plant.**

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Cull dairy cows are regularly removed from dairy herds and enter the marketing system which involves transport to auction markets and then to an abattoir. Many cull dairy cows are removed from the herds because of health reasons and their ability to withstand transportation may vary. Moreover, dairy producers lack feedback about potential transport delays and the condition of the cows throughout the transport continuum. The objectives of this study were (1) to follow cull cows from farm to abattoir, (2) to monitor changes in the cows’ condition, and (3) to record transport delays. From May 2017 to March 2018, data were collected from 20 dairy farms, 2 auction markets and at 6 abattoirs in British Columbia, Alberta, and the USA. The dairy farms were visited regularly before cows were shipped and a researcher scored the animals for body condition (BCS; 5-point scale), lameness (5-point scale) and udder condition (3-point scale). Logistic mixed effects models were used to test the effect of transport on the animals’ condition, with cow within farm as random effect. During the study, 1,171 cull cows were removed from participating farms and 714 of those animals were observed at one of the participating abattoirs. After leaving the farms, cows spent on average 82 h in the marketing system until being processed. Including delays at auctions or assembly yards, about 41% of cows were in transit for 4–5 d and 11% for 6–16 d. Regarding distance, 11% were transported 1,100 km from farm to abattoir. The percentage of thin cows increased from 8% at the farm of origin to 22% at the abattoir (P < 0.001). Lameness did not change, but transport increased the development of acute milk accumulation and udder inflammation from 8% at farm of origin to 41% at the abattoir (P < 0.001). At the auctions, 10% of the cows were thin (BCS ≤ 2), 7% were severely lame (lameness score ≥ 4), 13% had udder edema, and 6% had other injuries including abscesses (2.1% of cows), signs of diseases (2.0%), hobbles (0.9%), signs of pneumonia (0.3%), eye injury (0.2%), and lump jaw (0.1%). This information about delays to slaughter and changes in cow condition will now be communicated to producers and veterinarians.

**Key Words:** livestock market, transport