Animal Behavior and Well-Being 3

452   Survey of animal welfare and dairy management practices on 91 Organic Valley dairy farms. W. K. Fulwider*, *CROPP Cooperative, LaFarge, WI.*

The objective of this survey was to evaluate animal welfare on Organic Valley dairies across the United States. Cows were scored on 91 dairies between May 10, 2010 and January 20, 2011 in California, Indiana, Iowa, Michigan, North Carolina, Ohio, Oregon, Pennsylvania, Tennessee, Vermont, and Wisconsin. Dairies were selected from tight knit clusters in each area so the most farms possible would be surveyed in one week. All cows on each dairy were scored. Data were collected on body condition, locomotion, hygiene, hock lesions, broken and docked tails, hair coat, housing, and euthanasia. Body condition scores ranged from 1 to 5, with 1 being thin and 5 heavy. The percentage of cows with body condition score of 1 was 0.1, 2 was 69.1, 3 was 29.1, 4 was 4.8, and 5 was 0. Locomotion scores ranged from 1 to 5, with 1 being excellent and 5 unable to bear weight on at least one limb. Percentage of cows with locomotion score 1 were 97.0, 2 were 2.1, 3 were 1.0, 4 and 5 were 0. Hygiene scores ranged from 1 to 5, with 1 being clean and 5 soiled. Percentage of cows with hygiene scores of 1 were 67.2, 2.0 were 29.5, 3.0 were 1.9, 4.0 were 0.4, and 5.0 were 0. A tarsal score of 1 represented hair loss, 2 was moderate, and 3 indicated severe swelling. Percentages of cows with hock score 1 were 13.4, 2 were 1.1, and 3 were 0.1. A knee score of 1 represented hair loss, 2 swelling, and 3 severe swelling. Percentages of cows with knee score 1 were 2.0, 2 were 0.2, and 3 were 0. Percentage of cows with broken tails was 3.8. Percentage of cows with docked tails before organic transition or due to injury was 2.8. No bald spots, lice, or mange were observed on cow hair coats. Housing consisted of 32 farms with tiestalls, 28 free-stalls, 18 bedded packs, 7 stanchion barns, and 4 other. Some farms had more than one housing type. Gun was the preferred euthanasia method (92.1), followed by i.v. (7.9). Bedding cows housed due to inclement weather on a daily basis may improve hygiene scores. Incidence of broken tails was higher on larger farms with hired milkers. This is the most comprehensive survey to date of animal welfare and management on US organic dairy farms.

Key words: dairy, organic, welfare

453   A dairy quality assurance program for New Mexico dairy producers. F. A. Rivera*[1], G. R. Hagevoort[1], M. L. Kinsel[2], and M. A. Smith[1], *[1]NMSU Ag Science Center, Clovis, NM, [2]Agricultural Information Management Inc., Ellensburg, WA.*

The New Mexico Dairy Quality Assurance program was developed to evaluate management practices on dairies including biosecurity, animal care, calf management, milking barn management, nutrition, reproduction and animal health management. Input was obtained through a combination of producer interviews and animal observations. The program was developed to be compatible with the NMPF's FARM program (Farmers Assuring Responsible Management), but additionally address particular issues facing New Mexico producers. To date, about 25% of New Mexico's dairy producers have participated in the program. Many of the interview questions refer to the use of protocols for standardization of management practices. Eighty-three percent of producers stated they do have a written form of a herd health plan. All participating producers stated they had protocols for fresh cows, udder health, worker training, and non-ambulatory animals; however, most these protocols are not in a written form indicating a high level of reliance on verbal training of employees on procedures and pro-

tocols. Thirty 6 percent of producers indicated written protocols for fresh cows, while 36% indicated written udder health protocols, 37% for worker training, and 39% for non-ambulatory animals. Less than one half of the producers indicated to have protocols directly pertaining to biosecurity. Ninety-four percent of producers record withdrawal periods: 60% of which utilize some computer software. Utilizing the FARM method to determine the number of observations required to observe animal management and welfare practices proved to be a challenge on the large dairies in New Mexico (average herd size 2200). Specifically, dairies with large heifer programs with limited body condition or locomotion score problems tend to mask issues apparent in the adult milking strings. Results on New Mexico dairies showed that including a large heifer program in the evaluation can cut the percentage of body condition or locomotion scores in half, to a level where it seems not to warrant any further action and may go unreported.

Key words: quality assurance program, animal welfare, biosecurity

454   Effect of prior grazing experiences on grazing behavior and performance of lactating cows. F. Lopes*[1], N. M. Esser[1], P. C. Hoffman[1], W. K. Coblentz[2], and D. K. Combs[1], *[1]Department of Dairy Science, University of Wisconsin, Madison, [2]USDA-ARS, Marshfield, WI.*

The impact of grazing experiences early in life on grazing behavior and performance of lactating dairy heifers was evaluated in a 3-year study. Sixty-four Holstein and Holstein x Jersey calves were randomly assigned to one of 4 treatments (n = 16) in 2008. Treatments were combinations of managing heifers in confinement or on pasture: T1, grazed 2008 and 2009; T2, grazed 2008 and confined in 2009; T3, confined in 2008 and grazed in 2009; T4, confined in 2008 and 2009. All animals grazed as lactating cows in 2010. In 2008, T1 and T2 heifers were on pasture from August through October, and T3 and T4 were housed in bedded pack pens. In year 2, T1 and T3 grazed from June–September, 2009, while T2 and T4 remained in confinement. All 4 treatment groups calved between January and April, 2010, and grazed as primiparous cows from May through July. In 2009 and 2010 grazing activities were assessed by visual observations (9h/d) and by measuring movements with GPS units attached to each animal. Daily milk was also recorded in 2010. All data were analyzed using proc mixed (SAS) as a completely randomized design, with treatment and day as fixed effects. Paddock was the random effect. In 2009 on d1, heifers that had grazed in 2008 spent more time grazing than heifers with no grazing experience (78 vs. 35% of the time, $P < 0.05$). In 2010 on d1, time spent grazing was 62, 59, 76, and 13% for T1, T2, T3 and T4, respectively, with T4 ranking lowest ($P < 0.05$). In 2009 and 2010 on d 1–3, experienced heifers walked a greater distance in the pasture than inexperienced animals. Milk production was lowest initially for cows with no previous grazing experience (T4). Animals that had not grazed in 2009 (T2 and T4) produced less milk than those that had grazed in 2009 (T 1 and T3) on d 1–3. However, average (61d) daily milk over the entire experiment was not significantly different ($P > 0.05$) (30.5, 30.1, 31.5 and 29.6 kg for T1, T2, T3 and T4). Results indicate that previous grazing experience can impact behavior and milk production during the first 3 d on pasture. After that, no behavioral differences ($P > 0.05$) were noted in after d-3 in either study.

Key words: heifers, behavior, grazing

455 Effects of acute and chronic stress on immune- and inflammatory-response gene expression in beef calves. C. Terrill*, T. Friend, J. Sawyer, P. Riggs, L. Berghman, S. Garey, D. Riley, A. Adams, and M. Carter, *Texas A&M University.*

Transport stress research has shown correlations between stress, morbidity, and mortality in calves subjected to the traditional US market system, indicating compromised immune function. The objective of this study was to determine if expression of specific immune- and inflammatory-response genes differed between calves that were subjected to an acute stress (AS, weaned and handled for 1.5 h) and a chronic stress (CS, weaned, handled and transported over 3–4 d. Two groups of 40 calves, *Bos taurus* (n = 20) and *Bos indicus* cross (n = 20), weighing 181 to 250 kg were used in this study. Jugular venipuncture blood samples (9mL) were collected from AS calves within 1.5 h of separation from their dam, and from CS calves upon arrival at a north Texas feed yard. For gene expression analysis, RNA was extracted from leukocytes obtained from blood samples by filtration. The remaining sample was then centrifuged for measurement of plasma cortisol. A diagonal covariance mixed model ANOVA was used to determine effects of treatment, breed, and breed by treatment interaction on cortisol concentrations. Mean cortisol did not differ significantly between AS (16.40 ± 1.08ng/ml) and CS calves (18.06 ± 1.14ng/ml) ($P > 0.296$). Expression values for each gene were analyzed using linear models that considered the effects of treatment (AS and CS) and breed (*Bos taurus* and *Bos indicus*). An interaction of effects was detected for 3 genes ($P < 0.029$). Breed was influential for 5 genes ($P < 0.046$). After adjustment for multiple comparisons in expression values for AS and CS, significant differences were found in relative quantification for 33 genes ($P < 0.047$), with mean treatment differences ranging from 0.309 – 913.19. Similar cortisol concentrations in both the AS and CS calves indicate that both groups experienced significant stress. However, the gene expression differences show a greater immune response in the calves subjected to CS, indicating that these measurements may be more useful than cortisol for identifying detrimental long-term stress.

Key words: transport, cortisol, gene expression

456 Estimation of genetic parameters for gait in Canadian Holstein cows. N. Chapinal*[1,2], F. Miglior[3,4], A. Sewalem[3,4], A. M. de Passille[5], J. Rushen[5], M. A. G. von Keyserlingk[2], and D. M. Weary[2], [1]*Department of Population Medicine, University of Guelph, Guelph, ON, Canada, [2]Animal Welfare Program, University of British Columbia, Vancouver, BC, Canada, [3]Guelph Food Research Centre, Agriculture and Agri-Food Canada, Guelph, ON, Canada, [4]Canadian Dairy Network, Guelph, ON, Canada, [5]Agriculture and Agri-Food Canada, Agassiz, BC, Canada.*

Lameness is one the most important welfare and economic problems in modern dairy herds. No direct genetic selection for lameness resistance has been done so far. The objective of this study was to estimate the genetic parameters of gait for Holstein cows from a research farm in British Columbia. A total of 265 cows had their gait assessed from 1 to 26 times (mean ± SD = 7 ± 5 times) throughout their productive lives. Data were collected in different experimental studies, but only cows assigned to control groups, or data collected before treatments were applied were used. Overall gait was assessed using a 1-to-5 scale with half-integers where 1 = not lame and 5 = severely lame, based on 6 different gait components (head bob, back arch, asymmetry of the steps, tracking-up, joint flexion and reluctance to bear weigh in a particular limb). A linear animal model was used to analyze overall gait. The statistical model included the fixed effects of parity (1 to 9), the interaction between year and season of calving (2001 to 2009, 2 seasons/yr), the interaction between experiment and observer (11 experiments and 6 observers), the linear and quadratic regression of time at gait assessment (expressed as number of days before or after calving, if in dry or lactation period, respectively). The random effects of the model included animal, permanent environment and residual. Variance components were estimated with REML procedure using a DMU software package. Estimate of heritability for overall gait was 0.09. Research is in progress to estimate variance components of individual gait components.

Key words: lameness, heritability, linear animal model

457 Automatic estimation of body condition score from digital images. M. Caccamo*[1], G. Azzaro[1], G. Gallo[2], G. C. Guarnera[2], J. D. Ferguson[3], and G. Licitra[1,4], [1]*CoRFiLaC, Regione Siciliana, Ragusa, Italy, [2]IPLAB, Catania University, Catania, Italy, [3]University of Pennsylvania, PA, [4]DISPA, Catania University, Catania, Italy.*

Body condition score (BCS) is an indicator of cows' health status based on visual or tactile inspection. The human intervention in assessing BCS is the main limiting factor since it is subjective and requires time and well-trained experts. For these reasons, to fully automate scoring, or at least to assist the human expert in this task, state-of-the-art computer vision is an important application that can reduce subjectivity and speed the scoring process. The objective of this study was to explore the possibility to efficiently automate the process of quantitatively estimating the BCS of cows using images acquired by commercial low-cost digital cameras. Images were acquired using 2 cameras at 3 m from the ground placed above an exit alley from the milking robot in such a position to allow capturing images of the dorsal area of cows. The BCS of each cow was estimated on site by 2 technicians and properly associated to the cows' images. A statistical region merging algorithm was applied to the H channel of the hue, saturation and value (HSV) color space to segment images. Cows' shapes were extracted from the binarized images, cleaned from noise and aligned in a unique reference frame. The standardized contours were described then in terms of arc-length parameterization with a uniform sampling. A standard principal component analysis was applied to determine the components describing the many ways in which the body shape of different cows tend to deviate from the average shape. This mathematical representation allowed a mapping of cow's shapes into a vector space, whose metric was used for automatic estimation of BCS through regression approach. The proposed method was tested on a benchmark data set containing 148 images available through the Internet (www.corfilac.it/bcs) by means of the leave one out cross validation procedure and the regression error characteristic curves. Experimental results confirmed the effectiveness of the proposed technique (mean error 0.26) that outperformed other state-of-the-art approaches proposed in the context of dairy cattle research.

Key words: body condition score, digital imaging, body shape

458 Use of infrared thermography to identify thermoregulatory differences between heat-sensitive and heat-tolerant breeds of *Bos taurus* cattle. R. E. Chaffin[1], K. J. Hoernig[1], J. S. Johnson[1], J. K. Bryant[1], B. Scharf[1], D. K. Kishore[1], P. A. Eichen[1], E. S. Dierenfeld[2], and D. E. Spiers*[1], [1]*University of Missouri, Columbia, [2]Novus International, Inc., St. Charles, MO.*

J. Anim. Sci. Vol. 89, E-Suppl. 1/J. Dairy Sci. Vol. 94, E-Suppl. 1

465

Previous studies have shown that a breed of heat-tolerant *Bos taurus* cattle (i.e., Romosinuano; RO) maintain a lower core temperature than more heat-sensitive Angus cattle (ANG) even with a lower respiration rate during heat stress. A new study was performed to further identify regional skin differences between RO (Florida-derived; n = 5) and ANG (Missouri/Oklahoma-derived; n = 10). Animals were tested in the Brody Environmental Chambers (University of Missouri), with an adjustment period of 8 d at thermoneutrality (TN; 19–22°C), followed by 2 weeks of cycling heat stress (HS; 26–36°C). A thermal imaging camera (Fluke Corp., Everett, WA) was used to create thermal images of hooves, legs, rump, and shoulder areas during TN, early HS (HS1; d 10) and late HS (HS2; d 21) periods. Measured skin sites were shaved before the study, with rump and hoof sites being ~10x10cm. Only maximum values from each site were used to avoid wet areas. Temperature of all sites increased in the heat, with no shift from HS1 to HS2. Rump and hoof sites showed no differences across breed. ANG shoulder temperature was 1.9°C higher ($P < 0.05$) than ROMO in the heat. In contrast, overall leg temperature of RO was 1.9°C higher ($P < 0.05$) than ANG, with greater breed differences ($P < 0.05$) at TN and HS1 (2.3 and 2.0°C respectively), and no difference after adaptation at HS2. These results suggest that increased heat dissipation through the leg at all air temperatures may be a major avenue by which the heat-tolerant breed may efficiently radiate excess heat to the environment and maintain a lower core body temperature.

Key words: radiant, breed, heat stress

459 Effect of climatic on body temperature of dairy cows. J. C. Lees* and J. B. Gaughan, *The University of Queensland, Australia.*

It is generally accepted that body temperature (BT) is a reliable indicator of heat load status. However the effects of previous heat load on BT have not been determined. The aim of this study was to determine the effect of climate on BT, and to establish if BT lags changes in climatic conditions. BT of lactating Holstein-Friesian cows (n = 83) were collected at 10 min intervals over 5 to 7 d using temperature loggers (HOBO Pro V2) placed in the vagina. Cows had access to a feed pad and pasture and were kept outside in a sub-tropical environment. Ambient temperature (TA), black globe temperature (BG), and relative humidity (RH) were obtained every 10 min from an on-site weather station. Data were obtained during summer Jan/Feb (E), winter Jul/Aug (M) and summer Nov/Dec (L). Hourly means for BT, THI, BG, TA and RH were calculated for E, M and L. Multivariate ANOVA was used to determine residual correlations using partial correlation coefficients between BT and the climate variables. The lag effects of the variables on BT at h 0 were assessed by determining the relationships at −1, −2 and −3 h before 0 h. There were moderate correlations between BT, THI (0.51; $P < 0.001$) and TA (0.48; $P < 0.001$) at 0 h during E; and between BT, THI (0.47; $P < 0.001$) and TA (0.49; $P < 0.001$) at 0 h during L. There were weak correlations (≤-0.07; $P > 0.05$) at 0 h between BT, THI, TA and BG during M. At 0 and −1 h, the relationship between BT and BG was moderate during E (0.41 and 0.42 respectively; $P < 0.001$), whereas during L there was a stronger association at 0 h (0.42; $P < 0.001$), and at −1 h (0.40; $P < 0.001$). There was a weak relationship between BT and RH at 0 h during E (−0.14; $P < 0.001$), a moderate relationship during L (−0.35; $P < 0.001$), and a weak relationship during M (−0.06; $P > 0.05$). The lack of correlation between BT and climatic variables during M confirms that there was no adverse heat load during winter. It appears that BT is primarily driven by current or at the most the previous h ambient conditions during summer, at least on a herd basis. The relationship between BT and climate variables, in low, moderate and high production cows needs to be determined.

Key words: body temperature, dairy cows, heat load

460 Repeatability of subjective and objective measures of exit velocity as an indicator of temperament in feedlot cattle. M. D. D. Vetters*, T.E. Engle, J.K. Ahola, and T. Grandin, *Colorado State University, Fort Collins.*

Observations were collected for the purpose of comparing exit velocity evaluation; including a subjective rank scoring system (walk, trot, or run) and an objective measurement, to determine the repeatability of each measurement over time. Squeeze chute exit velocity was obtained for 1,100 crossbred yearling steers using a subjective (Sub) and objective (Obj) temperament scoring system. The Obj scoring system utilized infrared sensors to determine the time taken for an animal to traverse a fixed distance of 1.83 m, immediately after exiting the squeeze chute. The Sub temperament scoring measurement of: 1 = walk, 2 = trot, or 3 = run was assigned by 2 different observers when each steer crossed a fixed point between the infrared sensors. Observers also noted any incidence of jumping or falling by each steer. All animals were scored for each system (Sub and Obj) simultaneously upon exiting the squeeze chute on d 0 and d 21 of the experiment. The Sub score between observers on a single day showed considerable agreement (weighted Kappa 0.60) indicating the system is repeatable between different observers. However, the agreement for a single observer between d was only moderate (weighted Kappa 0.40) indicating a d effect for Sub score. In addition, although the mean velocities for d were not different ($P > 0.18$; 2.98 and 3.02 ± 0.04), the consistency of Obj exit velocity for each animal between the 2 weighing events was low (Spearman rank correlation coefficient = 0.25). These data indicate that the Sub and Obj measurement systems used in this experiment are reliable instruments for assessment on a given day; however, substantial variation exists for Sub and Obj temperament scoring across days. If this variation can be accounted for it could be possible to more accurately compare these systems of temperament assessment.

Key words: beef cattle, exit velocity, temperament

461 Group pasture versus stall housing effects on cortisol and DHEA concentrations in young Quarter Horses. S. M. Garey*, T. H. Friend, L. R. Berghman, J. E. Sawyer, M. M. Vogelsang, A. L. Adams, C. L. Terrill, and M. J. Carter, *Texas A&M University, College Station.*

Individual stall housing of horses is common in the US Whether horses are able to adapt to the stress of isolation, or if this type of housing presents a long-term stress for the animal is unclear. The objective of this study was to determine if cortisol or dehydroepiandrosterone (DHEA) differed among groups of young horses when housed in individual stalls versus in a group on pasture. Fourteen 2 to 3 year-old Quarter Horses were randomly assigned to either stall or pasture housing for 28 d. The 3.66 × 3.66 m stalls had solid concrete side and rear walls with a small ventilation window, while the front allowed horses to view the alley of the barn. The stalled horses were allowed 15 min of exercise 3 d per week. The 7 pasture horses were in one group on a novel 0.2 km² pasture. All horses were fed concentrate 2 times per day, while pastured horses had coastal grass, and stalled horses had coastal hay. Jugular blood samples were drawn at 24 h and 0.5 h before treatment, then every 12 h for 3 d, every 24 h for 5 d, and every 48 h for the

466

J. Anim. Sci. Vol. 89, E-Suppl. 1/J. Dairy Sci. Vol. 94, E-Suppl. 1

final 20 d. Plasma was analyzed by ELISA to determine cortisol and DHEA concentrations, and all samples were normalized against pre-treatment concentrations. A mixed model repeated measures ANOVA with unstructured covariance determined effects of treatment, sample time and sample time by treatment interaction. Stalled horses had significantly higher cortisol concentrations (4.62 ± 0.43 ng/ml) than pastured horses (3.27 ± 0.46 ng/ml, $P = 0.05$), although no significant differences were observed in DHEA ($P = 0.34$). There was no sample period by treatment interaction ($P = 0.55$). Plasma cortisol differences between treatment groups decreased in the final 4 d of the study, becoming equal by d 28. In conclusion, differences in cortisol concentrations between the treatment groups were significant, but diminished toward the end of the study. These results suggest that horses housed in an individual stall over an extended period of time may acclimate to the stress of isolation.

Key words: housing, stall, cortisol

462   Cortisol and DHEA concentrations in foals identified as high versus low behavioral responders during weaning. S. M. Garey*, T. H. Friend, L. R. Berghman, J. E. Sawyer, M. M. Vogelsang, A. L. Adams, C. L. Terrill, and M. J. Carter, *Texas A&M University, College Station.*

Weaning of young animals from their dams has been shown to induce stress. Frequent whinnying and increased movement displayed by foals are common behavioral indicators of distress. The objective of this study was to determine if cortisol or dehydroepiandrosterone (DHEA) differed among foals identified as high versus low behavioral responders during weaning. Fifteen 5 to 6 mo-old Quarter Horses were weaned by removal and relocation of their dams. Post-separation, the foals were housed in groups of 3 to 4 with ad libitum coastal hay and water. Jugular vena puncture blood samples were collected from the foals at 24 h and 0.5 h before separation, then every 24 h for 3 d and a final sample on d 5. To minimize stress during blood sampling, foals were handled and restrained in familiar stocks, with 2 foals per stock. Scan sampling at 2-min intervals for 30 min per day was done for 3 d post-separation to record movement, activity and number of vocalizations. Three observers also ranked the foals' display of distress relative to other foals in the study. Behavioral data were analyzed to rank and identify the 5 most distressed (MD) and 5 least distressed (LD) foals. A mixed model repeated measures ANOVA with unstructured covariance was used to determine differences in plasma cortisol and DHEA concentrations between MD and LD foals as well as sample time effects, and a Spearman correlation was used to identify associations between rank and average cortisol and DHEA. Cortisol ($P = 0.262$) and DHEA ($P = 0.298$) did not differ between MD and LD foals pre-weaning, and no interaction was found between the behavioral groups and sample time ($P = 0.167$). Overall, cortisol and DHEA did not differ between MD foals (9.97 ± 1.66 ng/ml, 3.39 ± 1.17 ng/ml) and LD foals (7.29 ± 1.66 ng/ml, $P = 0.287$; 0.38 ± 1.17 ng/ml, $P = 0.110$), respectively. Average DHEA was correlated with rank ($r = 0.661$, $P = 0.038$), however average cortisol was not ($r = 0.071$, $P = 0.80$). This study suggests that high responding and low responding foals may be experiencing similar distress during weaning.

Key words: weaning, behavior, cortisol

463   Preference for condensed tannins by sheep in resoponse to challenge infection with *Haemonchus contortus*. J. Juhnke[1], J. Miller[2], F. Provenza[1], J. Hall[3], and J. Villalba*[1], *[1]Utah State University, Department of Wildland Resources, Logan, [2]Louisiana State University, Department of Pathobiological Sciences, Baton Rouge, [3]Utah State University, Department of Animal Dairy and Veterinary Sciences, Logan.*

We determined the ability of parasitized lambs to modify their preference for a condensed tannin (CT)-rich feed after they experience the antiparasitic effects of CT. Twenty 2 lambs were familiarized with beet pulp (BP) and beet pulp + 8% quebracho tannins (BP+CT) and then given choices between the 2 feeds (before a parasitic infection). Subsequently, each animal was dosed with 10,000 infective larvae of *Haemonchus contortus*, and 22 d later they were exposed to BP (Control group; n = 11) or BP+CT (Treatment group; n = 11) for 24 d. After this exposure, animals in both groups were given a choice between the 2 feeds for 14 d. Feed intake, preference for BP+CT, fecal egg counts (FEC), and blood parameters were analyzed as a split-plot design with lambs (random factor) nested within group and day as the repeated measure. All lambs preferred BP to BP+CT throughout the study ($P < 0.001$) and no difference in preference for BP+CT was detected between groups before a parasitic infection ($P > 0.10$). However, during a parasitic infection, intake of and preference for BP+CT was higher for the Treatment than for the Control lambs ($P < 0.05$). When parasitic infections were terminated by chemotherapy, differences between groups in preference for BP+CT disappeared ($P > 0.05$). Preference for BP+CT by the Treatment group was higher during a parasitic infection than after chemotherapy ($P < 0.05$). Treatment lambs had lower FEC ($P < 0.05$), and red cell parameters indicated a lower degree of anemia in the Treatment than in the Control group ($P < 0.09$), suggesting tannins attenuated parasitic burdens. Thus, lambs needed to experience the beneficial antiparasitic effects of CT (Treatment) to increase their preference for the CT-containing food, indicating this behavior was learned. Preference for CT in the Treatment group was a function of parasitic infection as it subsided after chemotherapy. It may be possible through management programs to enhance utilization of tannin-rich forages and feeds by parasitized animals.

Key words: diet selection, endoparasites, foraging

464   Lack of acclimation in Holstein calves exposed to repeated transport. A. L. Adams*, T. H. Friend, G. A. Holub, S. M. Garey, C. L. Terrill, M. J. Carter, and A. J. Krenek, *Texas A&M University, College Station.*

Little is known about the adaptation of livestock to repeated transport stress. This study determined how repeated transport affected plasma cortisol (CORT) concentrations and post-transport calf behavior. Thirty-six 4-mo-old Holstein steer calves were housed in groups of 6 with each group randomly assigned to either transport (T) or control (C) treatments. T calves were transported for 6 h in their groups in a 7.3 m x 2.4 m goose-neck trailer divided into 3 compartments, at an average density of 0.87 m^2/calf, every 7 d for 5 consecutive wk. Location of groups within the trailer rotated. Simultaneous blood samples were obtained in the trailer or home pen via jugular venipuncture before loading, and after 2, 4, and 6 h of transport. Behavior was recorded for transported calves at 5-min intervals for 1 h after return to their home pens. CORT was analyzed as a repeated measure in a mixed model ANOVA. Latency to eat and lie down were analyzed in a mixed model ANOVA. Spearman rank correlations showed no association between CORT and behavior. The location of the calves in the trailer did not significantly affect CORT and basal CORT concentrations did not differ significantly for T calves. CORT during transit increased with each repeated transport, except during wk 5 ($P = 0.043$). CORT

J. Anim. Sci. Vol. 89, E-Suppl. 1/J. Dairy Sci. Vol. 94, E-Suppl. 1

467

concentrations peaked after 2 h of transit (11.17 ± 0.84 ng/ml) and decreased after 4 and 6 h of transit (4 h: 8.21 ± 1.17 ng/ml, 6 h: 5.73 ± 0.74 ng/ml, $P < 0.0001$). T calves had higher CORT concentrations than C calves after 2 h (C: 6.98 ± 0.86 ng/ml) and 4 h (C: 6.94 ± 1.2 ng/ml) of transit, but had lower CORT than C calves after 6 h of transit (C: 7.28 ± 0.76 ng/ml, $P < 0.0001$). Calves transported in the rear of the trailer were the first calves to lie down when returned to their pens ($P = 0.0008$) and the last calves to attend the feed bunk ($P = 0.022$).

As temperature-humidity index increased, calves located in the rear of the trailer began to lie down sooner post-transport ($P = 0.018$). These results suggest that calves did not start to acclimate after being transported 5 times and that calves transported in the rear compartment of the trailer were the most fatigued.

Key words: calves, cortisol, transport

468

J. Anim. Sci. Vol. 89, E-Suppl. 1/J. Dairy Sci. Vol. 94, E-Suppl. 1