Animal Behavior and Well-Being: Use of Animal Behavior to Assess Animal Welfare

206   Use of animal behavior to assess animal welfare. E. A. Pajor,* *Faculty of Veterinary Medicine, University of Calgary, Calgary, AB, Canada.*

The science of animal behavior (ethology) has been closely linked to the study of animal welfare. A major advantage of behavior as a welfare indicator is that it can be measured non-invasively. As a starting point, a species' natural behavior is often compared with its behavior in confinement. Although this approach provides some general information about the range and variation in behavior, it does little to indicate anything about animal welfare. A more rewarding approach currently used by many scientists is to try to determine how particular behaviors develop, understand their function and what motivates them to occur. For many animal welfare scientists an animal's subjective stat is an important, if not the most important aspect of animal welfare. Feelings are not directly observable, but have measurable correlates or consequences. They can be assessed either by giving animals some control over their environments and observing the choices and decisions they make, using preference and motivation tests or by looking for signs of deprivation, frustration or distress when the animal is confined in an environment or subjected to a treatment without any means of control. Although preference and motivation tests are techniques under development, if carefully interpreted they can constitute a powerful tool for the assessment of welfare. Another important research area is the study of the causes and prevention of abnormal behaviors such as stereotypies or injurious behaviors. These behaviors have often been interpreted as indicators of poor animal welfare but recent studies suggest that such interpretations are too simplistic. Another promising approach to evaluating animal welfare is through the study of cognition, learning and memory. The focus of scientific inquiry and policy development is shifting to include the study of positive welfare states. Additional research in understanding and quantifying such states is a significant challenge.

Key Words: behavior, welfare, assessment

207   Prevalence of hock, knee and neck injuries, stall dimensions and lying time on Canadian free-stall dairy farms. J. C. Zaffino*[1], C. G. R. Nash[1], T. J. DeVries[2], S. J. LeBlanc[1], D. F. Kelton[1], J. Gibbons[3], E. Vasseur[3,5], A. M. de Passillé[3], J. Rushen[3], K. Orsel[4], H. W. Barkema[4], L. Solano[4], G. B. Bond[4], and D. B. Haley[1], *[1]University of Guelph, Department of Population Medicine, Guelph, ON, Canada, [2]University of Guelph, Department of Animal and Poultry Science, Guelph, ON, Canada, [3]Agriculture and Agri-Food Canada, Agassiz, BC, Canada, [4]University of Calgary, Department of Production Animal Health, Calgary, AB, Canada, [5]Organic Dairy Research Centre, University of Guelph Alfred Campus, Alfred, ON, Canada.*

Hock, knee and neck injuries on dairy cows are important indicators of welfare, management, and inadequate stall design. We investigated the relationship between injuries, lying time and stall dimensions on 90 free-stall dairy farms in Ontario (n = 40) and Alberta (n = 50). We sampled 40 Holstein cows per farm, scoring injury severity on a 4-point (hocks, knees) or 3-point scale (neck). Higher scores indicated greater severity. The same cows were used to calculate farm average lying time by recording their activity over 4, 24-h periods using electronic data loggers. Bed lengths (brisket board to rear curb) and stall widths were recorded on every farm. The association of stall dimensions with herd prevalence of injuries was analyzed in a mixed logistic regression model. The mean herd prevalence (and range) of hock, knee and neck injuries (score > 1) was 33% (0 - 82%), 17% (0 - 81%) and 8% (0 - 65%), respectively. The median farm average lying time was 10.5 h/d (interquartile range: 10.2 - 11.3 h/d). Mean bed length was 178 cm (range: 151 - 226 cm). Mean stall width was 115 cm (range: 104 - 131 cm). Hock injuries were not associated with bed length (*P* = 0.82) or stall width (*P* = 0.98). Knee injuries were less prevalent on farms with wider stalls (odds ratio = 0.3 per 10 cm increase in stall width; *P* = 0.002) and may be attributed to increased lateral lunge space. Neck injuries were more prevalent on farms with longer stalls (odds ratio = 1.4 per 10 cm increase in bed length; *P* = 0.04) and may be related to the placement of the neck rail on these stalls, yet to be analyzed. This is the first study to examine the prevalence of injuries on Canadian free-stall dairy farms. The finding that injuries are common on some farms is concerning, yet the variation between farms demonstrates that a low level of injuries is attainable. Refinement of stall designs may contribute to a reduction of injuries.

Key Words: injury, stall dimensions, animal welfare

208   Gradual cessation of milking reduces milk leakage and anticipatory behavior in dairy cows at dry-off. G. Zobel*[1], D. M. Weary[1], K. Leslie[2], and M. A. G. von Keyserlingk[1], *[1]Animal Welfare Program, University of British Columbia, Vancouver, BC, Canada, [2]Population Medicine, University of Guelph, Guelph, ON, Canada.*

The welfare effects of abrupt cessation of milking at dry-off are not well understood, but the pain-minimizing effects of gradually reducing milk production are frequently discussed in human work. This study aimed to assess the effect of abrupt vs. gradual cessation of milking on dairy cow behavior, milk leakage and somatic cell score (SCS). Eighteen cows (with a mean milk production of 24 ± 5 kg/d) were randomly assigned to either abrupt milk cessation (i.e., dry-off on d0) or gradual milk cessation (i.e., skipped milkings beginning on d0; dry-off on d5) in 3 replicates. Dry cow antibiotic and teat sealant therapy was administered at dry-off. Measurements were taken d-3 to d8. Three periods were identified for behavior data: P0 (baseline; d-3 to d-1), P1 (abrupt cows dry, gradual cows milking; d0 to d4) and P2 (all cows dry; d5 to d8). Lying and feeding behavior did not differ in P1 and P2 so these periods were combined for these measures. Lying time was recorded using data loggers and 5-min video scan samples were used to measure feeding time and anticipatory behavior (i.e., waiting at the pen's exit gate). Milk leakage was monitored every 20 min for 2 h following the times when cows would have been milked before dry-off (0500 and 1500). Leakage was assessed using the periods after full dry-off (P1 for abrupt vs. P2 for gradual). Composite milk samples were taken before dry-off and after calving to determine SCS. Regardless of treatment, dry-off resulted in reduced lying time (877 vs. 799 ± 9 min/d), reduced lying bouts (11.1 vs. 8.6 ± 0.3 bouts/d) and increased feeding time (285 vs. 350 min/d; SE = 8). Compared with P0, abrupt cows showed a greater increase in anticipatory behavior (P1: OR = 6.0; 95% CI: 2.7 – 13.5 and P2: OR = 8.1; 95% CI: 3.1 – 20.8) than gradual cows (P2: OR = 2.7; 95% 1 – 6.9). Frequency of leakage was greater in abrupt vs. gradual cows (89 vs. 22%, Fisher's exact test). SCS increased at calving regardless of treatment (2.6 vs. 4.5 SCS; SED = 0.4) but returned to P0 levels by d6. Gradually reduced milking frequency results in reduced milk leakage and reduced time spent anticipating milking following dry-off.

Key Words: welfare, milking frequency, SCS

209   Physiological and behavioral responses to bovine respiratory disease. R. Toaff-Rosenstein*[1], L. Gershwin[2], A. J. Zanella[3], and C. Tucker[1], *[1]Department of Animal Science, University of California-Davis, Davis, [2]Department of Pathology, Microbiology and Immunology, School of Veterinary Medicine, University of California-Davis, Davis, [3]Chair, Animal Health and Welfare, Scottish Agricultural College, Edinburgh, UK.*

Bovine respiratory disease (BRD) is the most widespread disease in US beef cattle, affecting 14.4% of feedlot animals, yet early detection is relatively poor. An improved understanding of the coordinated sickness response, including behavioral and physiological changes, can help improve disease detection. BRD was predicted to cause fever accompanied by lower feed intake and average daily gain (ADG). It was also expected to decrease grooming and increase lying time, as non-essential behaviors are reduced and those associated with fever maintenance increased with illness. Healthy beef steers (300 kg) were challenged with bovine respiratory syncytial virus on d0 and *Histophilus somni* on d5 (BRD, n = 10) or sterile solution (healthy, n = 10). Days −2 to 7 from initial viral challenge, unless stated otherwise, and treatment were analyzed using a mixed model. To assess grooming (d −1, 4, 6, 7) a brush was provided 20 min/d and self-licking was recorded simultaneously. Body temperature (d 3 to 7) and lying behavior were measured 24h/d with a data logger. BRD steers had higher body temperature d3 to d6, with the greatest difference on d5 (42.1 ± 0.16 vs. $39.9 \pm 0.16°C$, $P < 0.001$). Feed intake declined in BRD steers starting d2 and remained significantly lower on all subsequent days (peak difference on d5, 2.4 ± 0.12 vs. $0.3 \pm 0.16\%$ body weight, $P < 0.001$). This was accompanied by decreased overall ADG in BRD steers (-2.4 ± 0.36 vs. 1.6 ± 0.36 kg/d, $P < 0.001$). BRD steers spent more time lying down on d3 and 4 (peak difference on d3, 16.1 ± 0.38 vs. 14.1 ± 0.43 h/d, $P < 0.001$). BRD steers explored the brush less overall (8.4 ± 0.17 vs. $15.2 \pm 0.17\%$ of observed intervals, $P = 0.029$) and performed less self-licking on d4 (0.3 ± 0.24 vs. $8.9 \pm 0.24\%$ of observed intervals, $P < 0.001$) but there was no effect of BRD on brush-grooming ($P = 0.209$), possibly due to insufficient sampling. These results indicate that the BRD sickness response occurs as early as d2 after viral challenge as indicated by decreased feed intake. Behavioral changes can be used detect BRD, but adequate sampling is required for accurate disease recognition. Automated monitoring of behavioral changes may be a promising way forward for improved, early BRD diagnosis.

Key Words: sickness response, bovine respiratory disease

210   Effect of prepartum grouping strategy on agonistic behavior of dairy cows. K. M. Lobeck,* M. I. Endres, P. R. B. Silva, and R. Chebel, *University of Minnesota, St. Paul.*

The objective of this study was to investigate the effect of 2 prepartum grouping strategies on agonistic behavior of dairy cows measured by displacements from the feed bunk. Treatments were 1) All-In All-Out (AIAO) - cows assigned to a pen as a group and no new cows added during a 5-wk close-up period and 2) control (CON) - weekly entrance of new cows to maintain a pen density of 44 cows. The study was conducted in a freestall sand-bedded dairy farm in south-central Minnesota. Eighty-eight AIOA and 138 CON Jersey cows were enrolled in the study over 2 repetitions. Cows were randomly assigned to one of the treatments 5 wk before expected calving date. Cows were balanced for body condition score and those cows with locomotion score >2 were not included in the study. Displacements from the feed bunk were measured during 3 h on the day of move-in (d0) at $13:00 \pm 1:00$ and following fresh feed delivery ($05:00 \pm 1:00$) on d 1, 2, 3 and 7 of each wk. Displacement rate was calculated as daily displacements divided by the number of cows in the pen to account for stocking density. Data were analyzed by Proc Mixed with day (week) as repeated measures. CON had greater number of displacements than AIAO (22.0 vs. 10.4; SE = 1.0; $P < 0.01$). Displacements during wk 1–5 were 12.7, 13.4, 13.4, 9.5 and 2.7 in AIAO and 32.3, 20.9, 23.1, 14.1 and 19.3 in CON, respectively (SE = 1.7; $P < 0.01$). There was a treatment by week interaction (SE = 2.3; $P < 0.01$). During wk 1, 2, 3 and 5 numbers of displacements were greater in CON than AIAO. Within AIAO, there were fewer displacements during wk 5 than wk 1–4. Within CON, wk 1 had greater displacements than wk 2–5. Displacement rate was greater in CON than AIAO (0.54 vs. 0.31; SE = 0.03; $P < 0.001$). Displacement rates in wk 1–5 were 0.29, 0.36, 0.37, 0.31 and 0.20 in AIAO and 0.78, 0.53, 0.58, 0.34, and 0.49 in CON, respectively (SE = 0.04; $P < 0.01$). There was a treatment by wk interaction (SE = 0.06; $P = 0.01$). During wk 1, 3 and 5, the CON treatment had greater displacement rate than AIAO in corresponding wk. Within AIAO, wk 5 tended to have a lower displacement rate than wk 2 ($P = 0.06$) and wk 3 ($P = 0.05$). In conclusion, AIAO resulted in fewer displacements and reduced displacement rate than CON.

Key Words: dairy behavior, dry cow, displacements

211   Individual differences in calf defense pattern in Red Angus beef cows. C. Flörcke,* T. E. Engle, T. Grandin, and M. J. Deesing, *Colorado State University, Fort Collins.*

Predation on livestock has increased causing difficulties in management of extensive beef systems. This study evaluates different calf defense patterns and maternal protectiveness within the first 24h past parturition. A total of 341 cow-calf pairs (95% Red Angus and 5% Angus x Hereford commercial crossbreds) were approached with an unfamiliar vehicle that performed circling movements, gradually decreased the distance between the vehicle and the cow-calf pair. Approach -, protective-, vocalization - and closest distance were collected with a digital range finder. Yes/No-classifications were made on calf defense patterns: protective behavior toward the calf (99.1% protective), aggressiveness of the cow toward the vehicle (13.2% aggressive), vocalization toward the calf (78% called calf) and flight behavior of cow and calf (no flight, walk and trot). Hair whorl pattern (HW) on the forehead of the animal was used as a measure of individual differences in temperament. HW pattern and age were collected when the animal was in a squeeze chute during routine handling. HW pattern was classified into: high, middle, low, abnormal, multiple HWs and no HW. Data analyses via ANOVA with Post-hoc Fisher's LSD Test showed a trend for the approach distance ($P = 0.057$). Post-hoc tests revealed that cows with a high HW ($P < 0.05$) or multiple HWs ($P < 0.05$) noticed the presence of the car at a further distance. Post-hoc tests for vocalization distance showed that cows with a high HW vocalized earlier (i. e. at a further distance; $P < 0.05$). The age of cows (3–6yrs) influenced protective behavior. Younger cows could be approached closer than older cows (3yrs vs. 5yrs of age: $P < 0.05$). When only high, middle and low HW pattern were analyzed approximately 50% of cows that trotted away performed aggressive movements ($Chi^2 = 18.3$, $P < 0.001$). Results suggest that individual differences in maternal protectiveness may be associated with HW pattern. The more vigilant a cow is toward her surrounding the more likely she will be able to detect danger for herself and her offspring.

Key Words: calf defense patterns, maternal protective behavior, temperament

212 Physiologic and behavioral responses of horses to shaded or unshaded pens in a hot, sunny environment. K. E. Holcomb*[1], C. L. Stull[1], and C. B. Tucker[2], [1]*University of California at Davis, School of Veterinary Medicine, Population Health & Reproduction, Davis, [2]University of California at Davis, Department of Animal Science, Davis.*

Housing recommendations for horses invariably include providing access to shade on hot, sunny days. The documented benefits of shade to livestock are assumed to apply to horses as well. However, this assumption has not been directly addressed and some owners do not believe horses require shade. This study measured physiologic and behavioral responses of individually-housed horses confined to completely shaded (S) or completely unshaded (NSh) dry-lot pens during the summer in Davis, CA. Twelve healthy adult horses in a crossover design experienced both treatments for 5 d each. The mean ambient temperature during observations (1200–1800 h) was 31.2°C in S and 31.9°C in NSh; relative humidity was 37.7% in S, 37.5% in NSh; black globe temperature was 33.4°C in S, 41.2°C in NSh; soil surface temperature was 30.6°C in S, 55.4°C in NSh. Rectal temperature (RT), respiration rate (RR) and skin temperatures (SK) were recorded hourly from 1230 to 1730 daily. RR was measured by observing flank movement. Behavior observations were recorded at 5-min intervals from 1200 to 1800 h daily to evaluate time spent walking, foraging, and standing near or away from water. Behavior and weather parameter data were averaged per hour for analysis. Data were analyzed using the Proc Mixed model in SAS, with horse as a random variable and ambient temperature as covariate, controlling for time of day. Results showed that RT was greater for NSh than for S (mean 37.8°C and 37.6°C respectively, SE 0.05, $P < 0.01$) as was true for RR (25.4 and 20.5 breaths per minute, SE 1.2, $P < 0.01$), and SK (35.7°C and 34.6°C, SE 0.1, $P < 0.01$). Horses in NSh spent more time than S standing near their water source (35.5% of observations versus 18.8%, SE 0.3, $P < 0.01$). There were treatment-by-time effects with larger treatment differences in RT and RR in mid-afternoon. Although RT and RR were within normal reference ranges, horses without access to shade showed significant physiologic and behavioral responses, suggesting the need to mitigate effects of the hot sun. These results can be used in developing and assessing standards of care for horses.

Key Words: horse, shade, welfare

213 Effect of a magnesium rich marine extract on behavior, salivary cortisol levels and skin lesions in growing pigs in response to mixing and an out of feed event. K. K. M. O'Driscoll*[1], D. Lemos Teixeira[3], D. O'Gorman[2], S. Taylor[2], and L. Boyle[3], [1]*Teagasc, Animal and Bioscience Research Department, Animal & Grassland Research and Innovation Centre, Grange, Dunsany, Co. Meath, Ireland, [2]Celtic Sea Minerals, Currabinny, Carrigaline, Co. Cork, Ireland, [3]Teagasc, Pig Development Unit, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork, Ireland.*

The aim was to investigate if a magnesium rich marine extract (Acid-Buf) would improve pig welfare in response to mixing and an out-of-feed event. 448 weaned (d 28) piglets were assigned to Control (CL; Mg 0.16%) or Acid-Buf (AB; Mg 0.18%) diets in single sex groups of 14. Seven pigs/pen were mixed with 7 of the same sex and diet from another pen: CL male, AB male, CL female and AB female (n = 4 of each) at d 56. At mixing, aggressive behavior and no. pigs involved per bout was recorded for 3 h from video. Postural behavior was recorded at 10-min intervals. At d 112 feed was removed for 21 h. After re-introduction of the feed pens were observed continuously for 8 × 2-min periods and aggressive behavior was recorded. Skin lesions of 4 focal pigs/pen were scored on the day before, and after, mixing and the out of feed event. Saliva samples were collected on d 56 and d 113 (1 h before and 1, 3 and 8 h after mixing/feed delivery post deprivation) and at 10:00 on d 55, d 57 d 58, d 112 and d 114 by allowing the 4 focal pigs to chew on a cotton bud for 1 min. Cortisol was analyzed by ELISA. Data were analyzed in SAS (Proc Mixed). At mixing, aggressive interactions lasted longer in males than in females (16:55 vs. 34:27 mm:ss, SE 03:38; $P < 0.01$) and more CL than AB pigs were involved/bout (2.13 ± 0.39 vs. 2.08 ± 0.34; $P < 0.05$). There was no effect of diet or sex on skin lesion scores, but AB females had lower cortisol concentrations than CL (1.51 ± 0.12 vs. 1.91 ± 0.13 ng/mL; $P < 0.05$). During the out-of-feed event, neither sex nor diet affected salivary cortisol levels, but males were more aggressive than females (0.182 vs. 0.122 aggressive interactions/pig/min; SE 0.019; $P < 0.05$), and CL pigs had higher skin lesion scores than AB pigs (13.2 ± 1.1 vs. 10.0 ± 1.0; $P < 0.05$). Supplementation with magnesium had some beneficial effects on pig welfare.

Key Words: welfare, magnesium, behavior

214 Neophobic reactions to a new flavored feed are overriden by social learning in pigs. J. Figueroa,* D. Solà-Oriol, J. F. Pérez, and X. Manteca, *Universitat Autònoma de Barcelona, Bellaterra, Barcelona, Spain.*

Social interactions help animals learn new features of their environment without a trial and error process. This could help to override aversion or neophobia of a particular ingredient or flavor after interacting with a conspecific that has just eaten these components. The aim of this experiment was to evaluate if observer piglets are able to prefer a flavored feed over their common (unflavored) feed by the effect of previous social interactions with models or demonstrators conspecifics. A total of 128 (49d old) weaned pigs, allocated in 16 pens (8 pig/pen), were used in this experiment. Half of animals (8 pens; G1) were exposed to a social learning process and the rest (8 pens; G2) acted as a negative control. In G1, 4 pigs/pen were randomly selected as observers and the rest acted as demonstrators. Demonstrator groups were temporarily moved to an empty pen where a flavored feed (anis (A) or garlic (G); 0.075%) were offered for 30 min. After that, demonstrator piglets were mixed again with the observer animals during 30 min. Flavors were counterbalanced across pens to act as the social flavor. After the interaction time, a double choice test between the flavored feed previously eaten by demonstrators (G1) and a control feed (known unflavored starter diet) was performed with the observer animals (G1) and with 4 animals from each control group. Feed intake was measured after 30 min. Data were analyzed using the GLM procedure of SAS®. Pigs showed higher intakes of the flavored feed in the social learning group (SLG) that in the control group (389 vs. 283g; $P < 0.05$). Higher intakes of socially learned flavored feed compared with the control feed (389 vs. 264g; $P < 0.01$) were observed in the SLG animals (G1). No feed intake differences were observed in the control group between the 2 feeds (283 vs. 325g for flavored and control feed). Social interactions with a conspecific animal that had a recent experience with a flavored feed enhanced the preference for that feed and could even override neophobia to new feed components.

Key Words: neophobia, social-learning, pigs