T1  Assessment of two pain management strategies following scoop dehorning in dairy calves. A. A. Barragan*, S. Bas, and L. da Costa, Department of Veterinary Preventive Medicine, The Ohio State University, Columbus, OH.

Dehorning of calves is routinely performed in dairy farms. Some advantages of dehorning include, safer handling, decreased injuries to other animals and/or humans, reduce the bruising of the carcass and the aggressive interactions between pen mates. However, dehorning requires pain management to minimize pain and improve welfare. Our objectives were to compare the effects of 2 consecutive treatments with 2 non-steroidal anti-inflammatory drugs (meloxicam [ME] and flunixin meglumine [FM]) on activity parameters (standing and lying time) and physiological parameters (rectal temperature and heart rate) in female Holstein calves after scoop dehorning. Holstein heifers (n = 36) aged 4 to 6 mo from 2 dairy farms were enrolled. On study d −7 HOBO accelerometers were placed on the rear leg of calves. On study d 0 (dehorning) calves were randomly allocated into 3 treatment groups: (1) ME (n = 13; 1.0 mg/kg P.O.); (2) FM (n = 13; 2.2 mg/kg I.V); and (3) Control (CON; n = 13; no dehorning). A cornual nerve block was performed with 2% lidocaine (4 mL) before dehorning. The horns were removed using a Barnes dehorning instrument. Treatments (ME, FM) were administered immediately after dehorning. On study d1, all calves were restrained and second treatment dose was administered to ME and FM calves. Accelerometers were removed on study d6. Physiological parameters were measured on study d −7, 0, 1, and 6. The data were analyzed as a randomized block design with repeated measures using ANOVA by the MIXED procedure of SAS. Dehorned calves (ME and FM) spent less time lying (P < 0.05; ME = 760 ± 18.49 min/d; FM = 763 ± 18.42 min/d; CON = 830 ± 18.83 min/d) and more time standing (P < 0.05; ME = 680 ± 18.49 min/d; FM = 677 ± 18.42 min/d; CON = 610 ± 18.83 min/d) the day after dehorning (d 1); and on d 3 and d 4 (P < 0.05) compared with CON. However, no difference in activity patterns was observed between ME and FM groups. No difference was found on rectal temperature and heart rate between groups. Results of this study suggest that scoop dehorning affects activity patterns, and that the 2 pain management strategies had a similar effect on calf behavior. Dehorning is a painful procedure and pain management strategies should be implemented to minimize pain and improve well-being of animals.

Key Words: dehorning, dairy calf, activity

T2  Pair housing of dairy calves in modified individual calf hutches. L. Whalin* and M. A. G. von Keyserlingk, Animal Welfare Program, Faculty of Land and Food Systems, University of British Columbia, Vancouver, BC, Canada.

The objective of this study was to determine if pair housing using a modified calf hutch on a commercial dairy farm would provide similar benefits to those previously described in research settings. Despite many benefits (e.g., weight gain, social behaviors, less fearfulness) of housing calves in small groups, individual calf hutches are still the predominant housing type in North America - perhaps because hutches are designed for one calf. Our modified hutch consisted of 2 individual hutches placed next to each other where both calves had access to both hutches and a common run. This study took place on a commercial farm in the Fraser Valley of British Columbia from May to November 2016. A week after birth, calves were randomly assigned to individual (n = 14) or paired (n = 8 pairs) hutches and fed milk 2/d using a nipple bottle. Calves were fed 6 L/d from d 1 to d 6, 10 L/d d 7 to d 35, and 6 L/d until d 56 (weaning). At each transition, milk volume changed over 48 h. Ad libitum access to calf starter, and water was offered beginning d 2. Feed intake was measured weekly until calves were 67 ± 5 d, while BW and health measurements were recorded weekly until the calves were 85 ± 5 d. When the calves were 56 d a novel food test occurred where the amount of food consumed in 30 min was measured. Mixed model and independent t-tests were conducted in SAS (version 9.3, SAS Institute Inc., Cary, NC) to assess the effect of housing on the intake of starter and novel feed. Starter intake did not differ during high milk allowance (P > 0.5), but pair housed calves ate more starter after the first reduction in milk (pair: 1.72 ± 0.20 kg/d; individual: 1.02 ± 0.15 kg/d; P < 0.01), and during the post-weaning period (pair: 3.51 ± 0.27 kg/d; individual: 1.71 ± 0.21 kg/d; P < 0.01). Pair housed calves also ate nearly 3 times as much novel feed (pair: 170.92 ± 37.75 g; individual: 57.69 ± 10.55 g; P < 0.02). In conclusion, joining adjacent hutches is a viable option for pair housing; providing social contact during the milk feeding period increases calves’ willingness to consume different feeds resulting in increases in solid feed intake and potentially reducing weaning stress.

Key Words: novelty, feed intake, commercial farm

T3  Veal calf health on the day of arrival to growers in Ohio. J. Pempek*, D. Trearchis, M. Masterson, G. Habing, and K. Proudfoot, The Ohio State University, Columbus, OH.

Veal calves are at high risk for disease and mortality in early life. Calves face several stressors before arriving to the grower, including long transport times, which may contribute to poor health. Our objectives were to (1) estimate the prevalence of poor health outcomes in veal calves on arrival to growers in Ohio, (2) determine risk factors for health outcomes on arrival, including auction site (spread across 5 states in the Northeastern US), and (3) determine if health outcomes on arrival predict early mortality. A physical examination was conducted on approximately 30 calves from 12 cohorts (n = 383 calves). Exams included a blood sample to determine packed cell volume (an estimate of dehydration using a cut-off >46%) and total protein (an estimate failure of passive transfer using a cut-off <5.5 g/dL). Diarrhea, respiratory disease, depression, navel inflammation, and a skin tent test (a second indicator of dehydration) were also recorded. Mortality within 4 wk of age was recorded from farm records. Descriptive statistics were used to describe the prevalence of calves with poor health outcomes upon arrival. Generalized linear mixed models were used to identify risk factors for poor health on arrival and assess if poor health increased the incidence risk of mortality. Upon arrival, 6% (95% CI: 4.4–7.6) of calves had failure of passive transfer, 14% (9.1–18.8) presented with diarrhea, 0.5% (0–1.3%) had respiratory disease, 14% (8.5–19.3) were depressed, and 27% (22.7–30.7) had inflamed navels. In addition, 35.1% (23.5–46.6) of calves were dehydrated using a skin tent test, but only 1.3% (0.0–2.9) were dehydrated based on the packed cell volume threshold. Auction site of origin was significantly associated with depression on arrival (P < 0.001), and tended to be associated with skin tent on arrival (P = 0.08). None of the health variables were predictors of early mortality; however, mortality was generally low for all cohorts (4.3%; 1.7–6.8). These results provide evidence that veal calves experience dehydration, diarrhea, navel inflammation, and depression on arrival to growers, and some health outcomes are dependent on auction site.

Key Words: dehydration, failure of passive transfer

Animal Behavior and Well-Being II
T4  Characterizing activity at social grouping in weaned dairy calves. K. C. Horvath* and E. K. Miller-Cushon, University of Florida, Gainesville, FL.

After weaning, dairy calves are commonly exposed to changing social environments, which are likely to influence activity patterns. We examined the activity of recently weaned dairy calves upon introduction to a social group. Holstein heifer calves (n = 26) were individually housed and provided milk (10 L/d) for 6 wk, and gradually weaned over 9 d. Calves were then introduced to group housing on pasture (15.2 × 45.7 m) in weekly cohorts (6 ± 2 new calves/wk; mean ± SD) at 60 ± 3 d of age. The group (9 ± 1 calves) always consisted of newly introduced calves and calves introduced the previous week. Calves were equipped with electronic data loggers (HOBO Pendant G data logger, Onset Computer Corp., Pocasset, MA) to measure daily standing time and bout frequency for a 2-wk observation period: the first week following grouping, and the second week, which began with addition of younger calves and removal of older calves. The effects of week and day on daily standing time and bout frequency were analyzed in a double repeated measures general linear mixed model. Additionally, standing time was summarized by hour to assess diurnal activity patterns. Activity data were subject to a week by day interaction (P < 0.003), with a peak on the day of introduction for standing time (8.8 ± 7.1 min/d; d 1 of wk 1 vs d 1 of wk 2; SE = 0.42; P = 0.0046) and bouts (20.5 vs 13.6 bouts/d; SE = 1.35; P < 0.001) but decreasing activity over wk 1 and stable activity during wk 2. Newly introduced calves also stood longer in the hour after introduction but spent less time standing later in the day, compared with their diurnal activity on the first day of the following week when younger calves were added (week by hour interaction; P < 0.001). These results suggest that the first few days of introduction to a social group have a marked influence on activity patterns, but that previously grouped calves are less responsive to the addition of new calves into the group.

Key Words: dairy calf, social housing, lying behavior

T5  Behavioral changes in group-housed dairy calves infected with Mannheimia haemolytica. C. L. Hixson*, P. D. Krawczel2, J. M. Caldwell2, and E. K. Miller-Cushon1, 1University of Florida, Gainesville, FL, 2University of Tennessee, Knoxville, TN.

Insight into sickness behavior may be the means to improving identification, management, and welfare of sick animals. The objective of this study was to identify components of sickness behavior in group-housed Holstein dairy calves infected with Mannheimia haemolytica. Calves (aged 3–7 weeks; 58.0 ± 12.0 kg BW) were group-housed based on age and BW in sand-bedded pens (6 calves/pen, 6.6 m²/calf) and provided pasteurized waste milk (8 L/d) 2 × /d. Within group, calves were randomly assigned to treatment. On d 0, treatment calves (MH; n = 12, 3/pen) were inoculated at the tracheal bifurcation with 3 × 10⁹ cfu of MH suspended in 5 mL of phosphate buffered saline (PBS) followed by a 120 mL wash PBS. Control calves (n = 12, 3/pen) were inoculated with 5 mL + 120 mL of PBS. Behavioral and health data were collected for 7 d post-challenge. Each calf was fitted with an accelerometer to record lying time and laterality. Rectal temperatures and respiratory disease scores (based on presence of cough, nasal or ocular discharge, and ear droop; 0 = normal; 5 = treat for illness) were obtained every 12 h. Data were analyzed in a general linear mixed model with day (or hour) treated as a repeated measure. Temperature was subject to a treatment by hour interaction (P = 0.015), peaking for MH calves at 12 h post-inoculation (40.1 vs 39.1°C; SE = 0.14, P < 0.001). Respiratory score was greater overall for MH calves (3.9 vs 3.2; SE = 0.2; P = 0.024). A treatment by day interaction was evident in lying time (P < 0.001), with MH calves lying down for longer on d 0 (19.9 vs 18.4 h/d; SE = 0.33, P = 0.023). MH calves also spent more time lying on their left side than right in the week following inoculation (9.9 vs 7.5 h/d; SE = 0.58, P = 0.006), with control calves expressing no lateral preference (P = 0.74). These results show that this challenge model resulted in calves experiencing a mild disease state. Increased lying time and lying laterality may be useful indicators of early stages of disease.

Key Words: dairy calf, respiratory disease, behavior


There is evidence that the health and welfare of young dairy calves may be improved by increasing milk allowance and by providing milk through a teat. These aspects are easily incorporated into automatic milk feeding systems, which promote group housing that has been demonstrated to be important for social development of calves. Little is known about how calves interact with automatic milk feeders (AMF). We investigated the effect of stall design features on calves learning to use the AMF. Sixty-six male and 53 female Holstein calves were enrolled at 4 d of age and introduced to a group pen and trained on an AMF; calves were allowed to suck on a trainer’s fingers and guided to the teat. Calves were allocated to 1 of 2 stall designs: with gated (open) side walls (n = 59), or with solid side walls (n = 60). The hypothesis was that solid stalls would result in a longer latency to approach and feed from the AMF. For a 72-h period after training to the AMF, data from the AMF were collected and calf behavior was monitored by video. Main outcomes measured were latency to first voluntary visit to the feeder, latency to first feeding, time spent in feeder, amount of milk drank, and exploratory behavior such as sniffing and licking of the feeder. Data were analyzed using a mixed-effect linear regression model. The overall latency for calves to first voluntarily drink (without barn staff leading them) from the feeder was 5.3 h greater (P = 0.05; SE = 2.7) with a gated side compared with solid. This voluntary visit differs from if the calf was brought to the feeder for re-training at a 12-h checkpoint to ensure at least 2 L every 12 h. The average time taken to first voluntarily drink was 23.7 h (min = 2.9, max = 69.1) with gated sides and 18.4 h (min = 3.2, max = 54.5) with solid sides. Male calves drank 2.0 L more (SE = 1.0; P = 0.05) milk over the 72-h study period than females. Results from this experiment show that simple features of a stall can influence how quickly calves adapt to an AMF. Based on these results, calves adapted to using the AMF quicker when the stall walls were solid versus gated style.

Key Words: calf, feeding, behavior

T7  Feeding behavior of cows fed with oregano and green tea extracts during the transition period. V. Fischer*, S. C. B. Stivian1, E. F. Vizzotto1, M. de Paris1, and M. B. Zanela1, 1Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil, 2Empresa Brasileira de Pesquisa Agropecuária, Pelotas, RS, Brazil.

This work aimed to investigate the effects on feeding behavior in dairy cows fed with Origanum vulgare or Camellia sinensis extracts during the transition period. Twenty-four Jersey cows with BW 430 ± 33 kg were randomly assigned to one of the following treatments: control (CO, no plant extract), green tea extract (GTE, 5 g/cow/day) and oregano extract (OE, 10 g/cow/day). Cows received the plant extracts mixed into the concentrate from −21 d to +21 d relative to parturition, were fed with 4 kg of concentrate and 21 kg of corn silage offered separately.
and were allowed to graze. Behavior was registered at 10-min intervals between milkings during 10 h on d −14, −7, −1, 7, 14, 21 relative to parturition. Data were submitted to variance analysis, using the Mixed procedure of SAS according to a completely randomized design, considering the effect of diet (n = 3), day of measurement (n = 6), diet by day interaction. There were not significant treatment by day interactions (P > 0.05). Cows fed GTE spent more time eating the concentrate, had more visits to the feeding trough with eating activity than cows fed CO or OE groups. Cows fed OE tended to have less visits to the feeding trough without eating and lower total time spent eating and time spent ruminating while lying than cows fed CO and GTE groups. Cows fed OE had higher time spent ruminating while standing than GTE group. Treatments did not influence time spent resting while lying or standing. Plant extracts affected distinctly feeding behavior, as GTE increased time spent eating and visits to the trough while OE decrease eating time and visits to the trough without feeding.

Table 1 (abstract T7).

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Key Words: behavior, dairy cow, plant extract

T8  The effect of overstocking different resources within a freestall pen on the behavior and physiology of lactating Holstein cows. C. B. Kesterson*, R. A. Black, N. L. Eberhart, E. M. Edwards, and P. D. Krawczel, Department of Animal Science, The University of Tennessee, Knoxville, TN.

The objective was to determine the effect of overstocking the headlock, the freestalls, or both at 160% on the physiology and resting behavior of dairy cattle. Holstein cows (n = 32) were housed in a freestall barn, fed a TMR at 0700 and 1530 h, and milked at 0830 and 1830 h daily. Groups (n = 4) were balanced by parity (1.8 ± 1.1) and DIM (224.3 ± 58.5 d). Treatments were 100% stocking density at freestalls (FS) and headlocks (HL), 100% stocking density at FS and 160% at HL, 160% stocking density at FS and 100% at HL, and 160% stocking density at FS and HL. Treatments were assigned using a 4 × 4 Latin square with 14-d periods followed by a 3-d washout. Accelerometers were affixed to a rear leg of each cow to collect lying behaviors (daily lying time, left, and right side lying time, bout duration, and number of bouts). Displacements 2 h after each feeding were evaluated using video data. On d 0, 7, and 14 of each period, fecal samples [to evaluate E. coli and coliform counts (cfu/mL)], hygiene scores, and milk samples were collected. A mixed model (SAS 9.4) was used to evaluate the effects of treatment. Relative to 100% at FS and HL, overstocking the FS or overstocking FS and HL decreased lying time (13.2 ± 0.4 vs 11.4 ± 0.4 or 11.7 ± 0.4 h/d, P ≤ 0.01). Decreased lying time was also evident when FS or both FS and HL were overstocked compared with only overstocking the HL (11.4 ± 0.4 or 11.7 vs. 0.4 vs 12.7 ± 0.4 h/d, P ≤ 0.04). No other lying behaviors differed (P ≥ 0.15). No differences in social aggregation at the feed bunk were evident (P = 0.22). E. coli and coliform in feces was not affected by treatments (P ≥ 0.32). Nor were any treatment effects on hygiene (P ≥ 0.43), milk fat (P = 0.47), protein (P = 0.67), and SCC (P = 0.78). In the short term, fecal shedding of pathogens, hygiene scores, and milk components were not altered by overstocking. However, cows could not compensate for reduced access to freestalls, regardless of feedback stocking density, resulting in lost lying time. It needs to be determined if this behavioral change is sufficient to alter other aspects of welfare and productivity in the long term.

Key Words: overstocking, cow, welfare


Generally, the calcium salts of fatty acids affect feed intake, however, it is unclear whether these affect feeding behavior including concentrate provision and voluntary visits in an automatic milking system (AMS). This study investigated whether supplementation of calcium salts of medium-chain fatty acids (MCFA) modified the feeding behavior and milking activity in an AMS. Six multiparous Holstein cows (initial days in milk, 202; initial BW, 707 kg; parity, 2.3) in a cow herd kept in a free cow traffic barn with AMS and the roughage intake control (RIC) system were used in a replicated 3 × 3 Latin square design with 21-d periods. Cows were fed a partly mixed ration (PMR) supplemented with MCFA. MCFA composed of 80% capric acid and 20% caprylic acid was added to PMR at 0%, 0.5%, or 1.0% of the total dry matter intake. All cows received the same PMR (EE, 3.3%; NDF, 44.3%) ad libitum. A concentrate diet (EE, 3.5%) was offered at the AMS in proportion to individual milk yield. Data of milking activity and ruminating time were collected from the AMS system. Feeding behavior was analyzed using the records by the RIC system. The meal was determined by a log survivor curve for intervals between feedings for each cow. Data were analyzed by ANOVA to determine effects of MCFA. Correlation coefficients (r) were determined between feeding behavior and milking activity. The MCFA did not affect milking activity and feeding behavior. However, ruminating time was found to be positively correlated (P < 0.01) with milk yield and daily milking frequency (r = 0.77 and r = 0.64, respectively). An increased daily milking frequency was associated (P < 0.05) with longer meal duration and decreased visiting frequency to the feed box with RIC system (r = 0.58 and r = −0.49, respectively). In conclusion, these results indicated that bovine behavior of cows in AMS was not affected by the MCFA, and individual difference in feeding behavior among cows could relate to individual variation of milking activity.

Key Words: automatic milking system, feeding behavior, milking activity

T10  Feeding behavior of lactating dairy cows with genomic predisposition for residual feed intake fed at two levels of dietary neutral detergent fiber. F. Sun*, M. Aguerre, J. Powell, K. Weigel, A. Pelletier, P. Crump, and M. Wattiaux, 1Department of Dairy Science, University of Wisconsin-Madison, Madison, WI, 2Department of Animal and Veterinary Sciences, Clemson University, Clemson, SC, 3US Dairy Forage Research Center, Madison, WI, 4Department of Computing and Biometry, University of Wisconsin-Madison, Madison, WI.
Our objective was to determine if genomic predisposition for residual feed intake (RFI) influenced the expected change in feeding behavior associated with increasing neutral detergent fiber (NDF) concentration in diet. Multiparous Holstein cows (n = 24) in mid-lactation were used in a randomized complete block design. Genomic and phenotypic data from previous trials were used to group cows as low RFI (L-RFI, −0.42 ± 0.01 kg/d) or high RFI (H-RFI, 0.34 ± 0.03 kg/d). Following a 2-week covariate period during which cows were fed a diet with 31.7% NDF (dry matter basis), half of the cows in each RFI group were assigned to a diet with either 30.8 (L-NDF) or 34.0% (H-NDF) NDF for 4 weeks. Cows’ feeding behavior during the last 24 h of the experimental period was recorded with video camera. Videos were visually analyzed every 2.5 min and activity was assumed to persist the whole 2.5 min. Daily dry matter intake (DMI) and milk production were recorded individually for each cow. Covariate and experimental data were analyzed separately with SAS mixed procedure. During the covariate period L-RFI cows had lower DMI and higher feed efficiency (FE, milk-and-fat-corrected milk/DMI) than H-RFI cows (25.6 vs. 26.6 kg/d, and 1.61 vs. 1.46, P ≤ 0.05). After 4 weeks of dietary changes, L-RFI cows tended to maintain greater FE than the H-RFI cows (1.64 vs. 1.47, P = 0.08), there was no dietary NDF by cow RFI interactions, and no RFI effects (P > 0.11) on any feeding behavior responses. Dietary NDF did not influence daily time spent eating or ruminating (181 ± 16.4, P = 0.20, and 396 ± 42.0 min/d, P = 0.12). However, cows fed H-NDF had lower DMI (25.4 vs. 23.6 kg/d, P = 0.03), tended to spend more time chewing (539 vs. 601 min/d, P = 0.08) and drinking (25 vs. 40 min/d, P = 0.07), had smaller meal size (2.34 vs. 1.81 kg DM/meal, P = 0.02) and spent more time eating, ruminating, and chewing per DMI (7.31 vs. 8.5, 15.2 vs. 18.3, and 22.5 vs. 26.8 min/kg DMI, P ≤ 0.05) than cows fed L-NDF. In this study, L-RFI cows maintained higher FE than H-RFI cows regardless of dietary NDF. Furthermore, most measured feeding behavior responses were influenced by dietary NDF but none of them were influenced by cow RFI or the dietary NDF by cow RFI interaction.

**Key Words:** chewing