

Animal Behavior and Well-Being I

M17 Associations between feed push-up frequency, lying and feeding behavior, and milk composition of dairy cows. Emily K. Miller-Cushon*¹ and Trevor J. DeVries², ¹*Department of Animal Sciences, University of Florida, Gainesville, FL*, ²*Department of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada*.

The objectives of this study were to assess the effects of feed push-up frequency on lying behavior and feed sorting of dairy cows, and to determine associations between behavior and milk composition. Lactating Holstein dairy cows ($n = 30$; parity = 1.9 ± 1.1 ; mean \pm SD) were individually housed in tie stalls, milked 2 \times /d, and offered ad libitum access to water and TMR (containing on DM basis: 25% corn silage, 25% grass/alfalfa haylage, 30% high-moisture corn, and 20% protein/mineral supplement), provided 1 \times /d. Cows were divided into 2 groups of 15 (balanced by DIM, milk production, and parity) and individually exposed to 2 treatments in a crossover design with 21-d periods: (1) infrequent feed push up (3 \times /d), and (2) frequent feed push up (5 \times /d). During the last 7 d of each period, DMI and milk production were recorded and lying behavior was monitored using electronic data loggers. During the last 2 d of each period, milk samples were collected for analysis of protein and fat content and feed samples were collected for particle size analysis. The particle size separator had 3 screens (19, 8, and 1.18 mm) and a bottom pan, resulting in 4 fractions (long, medium, short, fine). Sorting was calculated as the actual intake of each particle size fraction expressed as a percentage of the predicted intake of that fraction. Data were analyzed in multivariable mixed-effect regression models. Feed push up frequency had no effect ($P > 0.3$) on lying time (11.4 h/d; SE = 0.37) or feed sorting; cows sorted ($P < 0.001$) against long particles ($78.0 \pm 2.2\%$; mean \pm SE) and for short ($102.6 \pm 0.6\%$) and fine ($108.4 \pm 0.9\%$) particles. Milk fat content increased ($P < 0.001$) by 0.1% for every 10% increase in sorting for long particles and was not associated with lying behavior or other cow-level factors. Milk protein content increased ($P < 0.003$) by 0.07% for every 1 h/d increase in lying time and by 0.05% for every 10% increase in sorting in favor of long particles. These results suggest that reduced lying time and sorting against long ration particles negatively affected milk composition. Further, this study did not find that altering feed push-up frequency affected feed sorting.

Key Words: feed sorting, lying behavior, milk

M18 Effect of timing of feed delivery on feeding behavior and productivity of dairy cows. Meagan T. M. King*, Robin E. Crossley, and Trevor J. DeVries, *Department of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada*.

The objective of this work was to assess the effect of timing of feed delivery on behavior and productivity of cows milked 3 \times /d. Twenty-four lactating Holstein dairy cows (7 primiparous and 17 multiparous), milked 3 \times /d (at 1400, 2100, and 0700 h), were individually exposed to each of 2 treatments (over 21-d periods) in a replicated crossover design. Treatments were the manipulation of timing of TMR delivery, 2 \times /d, in relation to milking time: (1) feeding at milking time (at 1400 and 0700 h) and (2) feeding halfway between milking times (at 1730 and 1030 h). Milk production, feeding, and rumination behavior were electronically monitored for each animal for the last 7 d of each treatment period. Milk samples were collected for 2 of the last 4 d of each period for milk component analysis. Data were then summarized across treatment period by cow and analyzed in a general linear mixed model. With a feed delay, DMI was lower (26.3 vs. 27.6 kg/d; SE = 0.6; $P =$

0.04). Although there was no difference in feeding time (230.2 min/d), cows fed with a delay consumed their feed slower (0.12 vs. 0.13 kg DM/min; SE = 0.003; $P < 0.001$) and had more meals (10.1 vs. 9.2 meals/d; SE = 0.3; $P = 0.02$), which were smaller in size (2.8 vs. 3.1 kg/meal; SE = 0.1; $P = 0.008$) and shorter (27.9 vs. 30.8 min/meal; SE = 1.3; $P = 0.03$). Rumination time (8.7 h/d) and lying time (9.9 h/d) were similar between treatments. Cows without fresh feed at their 1400 h milking stood for less time following that milking (72.2 vs. 86.4 min; SE = 6.9; $P = 0.045$), however, no differences in this latency to lie down were seen for either of the other 2 milking times. Milk yield (46.3 kg/d), milk fat content (3.65%), milk protein content (2.90%) were similar between treatments. Given the difference in DMI and no change in yield, with a feed delay, efficiency of production was improved (1.80 vs. 1.69 kg milk/kg DMI; SE = 0.04; $P = 0.01$). These data suggest that moving the timing of feed delivery away from milking resulted in cows consuming their feed more slowly in smaller, more frequent meals, contributing to an improvement in efficiency of production.

Key Words: feed delivery, meal pattern, behavior

M19 Relationships between dry matter intake, rumination time, lying behavior, and milk yield in lactating cows. Dafu Shao*, Fengxia Wang, YaJing Wang, Shengli Li, and Zhijun Cao, *State Key Laboratory of Animal Nutrition, College of Animal Science and Technology, China Agricultural University, Beijing, China*.

The objective of this study was to investigate the relationship between dry matter intake (DMI) and rumination time (RT), lying behavior (lying time and frequency), and milk yield in dairy cows. Data were collected from 32 mature Holstein dairy cows (16 primiparous, PR; 16 multiparous, MP, parity = 1.7 ± 0.8 ; milk production = $10,019 \pm 166$ kg/year; mean \pm SD). DMI was monitored using Insentec feed bins (Insentec BV, Marknesse, the Netherlands). RT was monitored electronically using HR-Tags (SCR Engineers Ltd., Netanya, Israel). Lying behavior was monitored using an activity logger (HOBO Pendant G; Onset Computer Corp., Cape Cod, MA). Data were analyzed by the R programming language (Mathsoft). According to the level of RT, cows were assigned to the low-RT group (L: RT = 277.65 ± 39.61 min/d; 8 PR and 8 MP) and the high-RT group (H: RT = 413.21 ± 46.89 min/d; 8 PR and 8 MP). One-way ANOVA was used to analyze the difference between H and L groups. There was no significant difference between H and L group in DMI (H: 20.59 ± 2.63 kg/d; L: 20.31 ± 3.34 kg/d; $P = 0.79$), lying behavior (lying time, H: 690.44 ± 155.46 ; L: 773.00 ± 163.41 , $P = 0.20$; Lying frequency, H: 11.25 ± 3.14 , L: 10.79 ± 3.39 , $P = 0.43$), and milk yield (H: 32.04 ± 6.00 kg/d; L: 32.15 ± 4.31 kg/d; $P = 0.95$). Pearson correlation was used to describe associations among DMI, RT, lying behavior (lying time and frequency) and milk yield. Multiple Linear Regression analysis was performed with lm package of the R programming language. A significant positive relationship existed between DMI and milk yield ($P = 0.01$, $r^2 = 0.93$). Rumination time ($P = 0.34$) and lying behavior (Lying time, $P = 0.36$; and Lying frequency, $P = 0.14$) were not affected by DMI. Only the milk yield ($P < 0.01$) was significantly affected by DMI, and the equation was $DMI = 8.97934 + 0.35762 \times MY$, $R^2 = 0.3865$, and which MY represents milk yield. These results indicate that milk yield can be used to estimate DMI; however, RT and lying behavior are independent variables and not the suitable indicators for DMI.

Key Words: rumination time, lying behavior, DMI

M20 Association between lying behavior and subclinical ketosis in transition dairy cows. Emily I. Kaufman^{*1}, Stephen J. LeBlanc², Brian W. McBride¹, Todd F. Duffield², and Trevor J. DeVries¹, ¹*Department of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada*, ²*Department of Population Medicine, University of Guelph, Guelph, ON, Canada*.

The objective of this study was to characterize the relationship between lying behavior and subclinical ketosis (SCK) in transition dairy cows. A total of 339 dairy cows (107 primiparous and 232 multiparous) on 4 commercial dairy farms, in Eastern Ontario, Canada, were monitored for lying behavior and SCK from 14 d before calving until 28 d after calving. Daily lying time was measured using automated data-loggers 24 h/d. A blood sample was taken from the coccygeal vein of each cow for measurement of β -hydroxybutyrate (BHBA) 1x/wk. Cows with BHBA ≥ 1.2 mmol/L postpartum were considered SCK. Cases of retained placenta, metritis, milk fever, or mastitis during the study period were also recorded. Cows were categorized into 1 of 3 groups: healthy (H) cows had no SCK or any other health issue ($n = 139$); SCK (K) cows with no other health problems during transition ($n = 97$); or ketotic plus (K+) cows that had SCK and one or more other health problems ($n = 53$). Data were summarized by wk and analyzed in a repeated measures general linear mixed model. A 3-way interaction was found between parity, disease status, and wk ($P < 0.001$); thus, first lactation and multiparous (MP) cows were analyzed separately. There was no difference among H, K and K+ ($P = 0.5$) in daily lying time from 2 wk before (-2) to 4 wk after calving (+4) for first-lactation cows. In MP cows, an interaction of disease status and week was detected ($P < 0.001$). Prior to calving, lying time was similar for MP cows (746 ± 32.8 min/d), decreasing ($P < 0.001$) after calving to an average of 598 ± 10.8 min/d. Differences in lying time for MP cows were seen in wk +1 when K+ cows spent 92 ± 24.0 min/d more time ($P < 0.001$) lying down than H cows, and during wk +2 where K+ cows tended ($P = 0.07$) to spend 38 ± 21.3 min/d more time lying down than H cows. Differences in lying time were also seen in MP cows in wk +3 and +4 where K cows spent 44 ± 16.7 min/d and 41 ± 18.9 min/d, respectively, more time ($P \leq 0.03$) lying down than H cows. Overall, these results suggest that monitoring lying time might contribute to identifying MP cows experiencing multiple health issues, including SCK, after calving.

Key Words: transition cow, lying behavior, subclinical ketosis

M21 Metritic heifers search for a safe place. Julia C. Lomb¹, Julie M. Huzzey², Heather W. Neave^{*1}, Daniel M. Weary¹, Bianca Costa¹, and Marina A. G. von Keyserlingk¹, ¹*University of British Columbia, Vancouver, BC, Canada*, ²*California Polytechnic State University, San Luis Obispo, CA*.

Isolation from the group is a common behavioral response to illness in social animals. Modern freestall barns do not provide a refuge area for sick cows, but animals feeling ill may be able to use the lying stall itself to get away from herd mates. First-lactation cows are smaller, and thus better able to stand with all 4 feet in a stall and benefit from its protection. The objective of this study was to determine if these cows increase standing in the stall when they develop metritis, a common uterine infection. Metritis diagnosis was based on vaginal discharge, scored on every third day between calving and 21 d in milk (DIM). First-lactation cows identified as metritic (M, $n = 8$) were paired with healthy individuals (H, $n = 8$), based on body weight and days in milk. Cows were housed in a dynamic, mixed-parity group of 20 and had access to 24 lying stalls. Cameras installed above the experimental pen allowed for 24 h of continuous observation. Time spent standing with either the 2 front feet or all 4 feet in the stall was measured using 5-min

scan sampling of the video recordings. The observation period included the 3 d before diagnosis in the metritic animals and the corresponding DIM for healthy pairs. A Mixed procedure in SAS (SAS Institute Inc., Cary, NC) was used for statistical analysis. Time standing with 4 feet in the stall was normalized using a log-transformation; values reported are back-transformed geometric means and 95% CI. Metritic heifers spent more time standing with all 4 feet in the stall (102.5 , 49–214 min/d; mean, 95% CI) than the paired healthy heifers (10.5 , 5–22 min/d; mean, 95% CI; $P < 0.001$). Differences in time spent perching with the 2 front feet in the stall were not significant (M: 209.6 ± 31 ; H: 284 ± 31 ; LS means \pm SE; $P > 0.1$). There was no significant difference in overall time spent standing in the stall. We suggest that cows experiencing malaise with the onset of metritis spend more time standing with 4 feet in the stall because they perceive this to be a protective environment.

Key Words: sickness behavior, disease, standing behavior

M22 Feeding and social behaviors change prior to metritis diagnosis in transition dairy cows. Heather W. Neave^{*}, Julia C. Lomb, Julie M. Huzzey, Daniel M. Weary, and Marina A. G. von Keyserlingk, *University of British Columbia, Vancouver, BC, Canada*.

Metritis is common in the days after calving and can reduce milk production and reproductive performance. Early identification of metritic animals may improve the welfare of affected dairy cows and the economic viability of the farm. The aim of this study was to identify feeding and social behaviors that could be used for the early detection of metritis. Healthy Holstein cows were enrolled in the study 3 wk before calving and all behaviors were recorded using an electronic feeding system. Metritis was diagnosed based on condition of vaginal discharge assessed on d 6 after calving. Twenty-one primiparous and 12 multiparous cows were diagnosed with metritis (more than 50% pus, or watery and red-brown in color with putrid smell) with no other health conditions; these were compared with 49 healthy primiparous and 96 healthy multiparous cows. In the 5 d leading up to clinical diagnosis, metritic primiparous cows ate less (metritic: 13.0 ± 0.42 kg DM/d; healthy: 14.6 ± 0.27 kg DM/d), spent less time eating (metritic: 137.7 ± 5.9 min/d; healthy: 152.1 ± 3.8 min/d) and had fewer visits to the feed bins per day (metritic: 53.8 ± 3.1 ; healthy: 65.5 ± 2.0) compared with healthy primiparous cows; healthy and metritic multiparous cows did not differ in these measures. No differences were found between healthy and metritic primiparous or multiparous cows in feeding rate and number of meals per day. Metritic multiparous cows were more likely than healthy multiparous cows to be competitively replaced at a feed bin by another cow (proportion of total feed bin visits where cow was replaced; metritic: 0.25 ± 0.02 vs. healthy: 0.20 ± 0.01). We conclude that cows at risk for metritis can be identified by changes in feeding and social behavior in the days before diagnosis.

Key Words: sickness behavior, disease, intake

M23 LPS injection in pregnant ewes and the number of lambs born affect maternal behavior and the time to first suckling. Cristiane G. Titto^{*1}, Fábio L. Henrique¹, Evaldo A. L. Titto¹, Adroaldo J. Zanella², Henrique B. Hooper¹, Lina F. P. Rodriguez¹, Ana Luisa S. Longo¹, Thays M. C. Leme-dos Santos¹, Raquel F. Calviello¹, Jessica C. Veronezi¹, and Alfredo M. F. Pereira³, ¹*Faculdade de Zootecnia e Engenharia de Alimentos, Universidade de São Paulo, Pirassununga, São Paulo, Brazil*, ²*Faculdade de Medicina Veterinária e Zootecnia, Universidade de São Paulo, Pirassununga, São Paulo*,

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Stress during gestation and multiple births can alter postpartum maternal care in sheep. The objective of this study was to determine the effect of LPS injection during the second and last third of gestation and the number of lambs born per ewe on maternal behavior and time to first suckling. Pregnant multiparous crossbred Santa Ines ewes were challenged with an intravenous administration of 0.8 µg·kg⁻¹ of lipopolysaccharide *E. coli*, or saline. Forty-two ewes were placed in individual pens with full open view of other animals, inside of a barn, during an adaptation period of 5 d. Ewes had free access to water, shade and food. Ewes were divided into 3 groups: CG - control group, (n = 14) that were not subjected to LPS injection; SG – stress at second third of gestation (70 d; n = 14); LG – LPS injection during the last third of their gestation period (120 d; n = 14). Behavior was recorded as positive (facilitated and encouraged suckling) and negative maternal behavior (aggressive, lack of co-operation with the lamb's sucking attempts) using 1-min scan sampling interval. Data were recorded from the time of birth until the first effective suckling event. If there were multiple births (2 lambs), each lamb was assessed separately. Data were analyzed as a completely randomized design using MIXED/SAS, and the ANOVA model had gestation LPS injection and the number of lambs born as the fixed effects as their interaction. Differences between LPS injection periods x birth were significant at a $P < 0.05$. Mother-offspring positive interactions were observed more than negative interactions ($P < 0.05$), except for the LG with multiple births, where the opposite occurred. Negative interactions were only observed in ewes with multiple births ($P < 0.05$). Lambs born from ewes in SG and LG groups, in twin births, spent more time until the first suckling ($P < 0.05$). It is likely that the delay in colostrum intake decreases the immunological capacity of the lamb, and the success of the ewe and lamb bond. LPS injection, which mimics a disease process, in late pregnancy is more harmful to the newborn lamb increasing negative maternal behavior and the time to first suckling.

Key Words: LPS, sheep, welfare

M24 Effect of increasing levels of babassu flour starch on feeding behavior of feedlot lambs. Michelle de Oliveira Maia Parente¹, Osman José de Aguiar Gerude Neto¹, Paull Andrews Carvalho Santos¹, Henrique Nunes Parente¹, Miguel Arcaño Moreira Filho¹, Ruan Mourão da Silva Gomes*¹, Itamara Gomes França¹, Arnaud Azevedo Alves², and Valdi Lima Júnior³, ¹Universidade Federal do Maranhão, Chapadinha, Maranhão, Brazil, ²Universidade Federal do Piauí, Teresina, Piauí, Brazil, ³Universidade Federal do Rio Grande do Norte, Natal, Rio Grande do Norte, Brazil.

Babassu (*Orbignya phalerata* Mart.) is a palm tree native to Brazil's northeast and north states that appears between Cerrado and the Amazon rain forest. Usually, each tree produces 15 to 25 bunches of fruit, each fruit weighting 98 to 280 g. The average weights of each component of the babassu coconut are 11% exocarp, 23% mesocarp, 59% endocarp and 7% kernels. From mesocarp can be extracted a flour, whose composition is 60% starch. The use of babassu flour starch can be used as an energy source for ruminants, however because of composition, it is important to study the feeding behavior. Twenty crossbred lambs (initial BW of 21.6 ± 3.5 kg and 120 d old) were used in a randomized complete block design according to initial BW and age. Lambs were penned individually during 50 d and fed an isonitrogenous diet (16.5 ± 0.2 CP, DM basis) containing 70% concentrate and 30% coastcross hay. Increasing levels of BSF were 0, 10, 20 and 30%, DM basis, corresponding to the experimental diets BFS0, BFS10, BFS20 and BFS30, respectively. Animals were monitored

every 5 min during 24 h, on the 25th day of the experiment, according to the activities: eating, rumination, idle and other activities. The feed and rumination efficiencies, expressed as g DM/hour were obtained by dividing the average daily intake of DM by the total time spent eating and ruminating in 24 h, respectively. Orthogonal polynomials for diet responses were determined by linear and quadratic effects. Effects were declared significant at $P \leq 0.05$. There was a quadratic response ($P \leq 0.05$) for time spent in eating (164.0, 231.0, 270.0 and 250.0 min/d for BFS0, BFS10, BFS20 and BFS30), time spent in other activities (289.0, 206.0, 179.0 and 168.0 min/d for BFS0, BFS10, BFS20 and BFS30) and eating efficiency on DM (402.9, 331.6, 234.5 and 180.7 g DM/hour for BFS0, BFS10, BFS20 and BFS30). The increasing levels of BFS did not affect ($P \geq 0.05$) the time spent in rumination, rumination efficiency and time spent in idle. It is concluded that increasing BFS levels changed the feeding behavior of lambs, especially for time spent for eating and feed efficiency.

Key Words: feed efficiency, mesocarp, rumination

M25 Residual feed intake selection: Effect on gilt behavior in response to a lipopolysaccharide challenge. Samaneh Azarpanjoh*¹, Jessica Colpoys¹, Anoosh Rakhshandeh^{1,2}, Jack Dekkers¹, Caitlyn Abell³, Nicholas Gabler¹, and Anna Johnson¹, ¹Department of Animal Science, Iowa State University, Ames, IA, ²Department of Animal and Food Sciences, Texas Tech University, Lubbock, TX, ³DNA Genetics, Columbus, NE.

Increasing feed efficiency in swine is important for increasing sustainable food production and profitability for producers. However, it is unknown if selection for improved feed efficiency impacts the expression of sickness behavior. The objective of this study was to characterize gilt behaviors and postures when challenged with lipopolysaccharide (LPS). This work was conducted with 7 low residual feed intake (LRFI; more feed efficient) and 8 high RFI (HRFI; less feed efficient) gilts (63 ± 4 kg BW) from the 8th generation of the ISU Yorkshire RFI selection lines. All gilts were individually housed in metabolism crates. Gilts were challenged I.M. with 30 µg/kg BW *Escherichia coli* O5:B55 LPS at 10:00 ± 1 h. Gilts were video recorded one day before LPS challenge (baseline) and on the treatment day (LPS challenge). Video was analyzed using a 1-min scan sample interval at 2 time points; 1) for 2 h starting at the time of treatment injection and 2) for one hour starting at the evening feeding time (~17:00h). Standing, sitting, lying, eating, and drinking were recorded. Data were analyzed using the GLIMMIX procedure of SAS. The model included line, treatment, time, and the interaction, with a random effect of pig nested within replicate. There was no line by treatment interaction for behaviors and postures ($P \geq 0.32$). There were no selection line behavioral and postural differences in response to the LPS challenge ($P \geq 0.45$). Regardless of selection line, after the LPS challenge gilts laid more ($P < 0.0001$) and stood less ($P < 0.0001$). For the other behaviors and postures there were no treatment differences ($P \geq 0.16$). In conclusion regardless of divergent selection for RFI, the LPS challenge affected lying and standing behavior in gilts in the same way. This project was supported by USDA-AFRI Grant no. 2011-68004-30336.

Key Words: gilt, lipopolysaccharide challenge, residual feed intake

M26 Effects of light programs and tryptophan supplementation on stress indicator parameters and growth of weaned piglets.

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Stressors such as weaning, social structure and environmental changes reduce piglet performance. Tryptophan (Trp) as a precursor of cerebral 5-hydroxytryptamine (5HT, serotonin) and melatonin may mitigate stress of animals. The photoperiod controls the transformation of Trp in its metabolites which in turn influence the consumption and welfare of piglets. This study aimed to evaluate the effects of light program and Trp levels on growth performance, blood glucose and plasma cortisol profile of piglets. Seventy-two 21-d-old piglets (initial BW = 6.6 ± 2.33 kg) were allotted to 4 treatments stratified by sex and initial BW with 6 pens/treatment and 3 piglets/pen. Data were analyzed as randomized complete block design in a 2 × 2 factorial arrangement (light programs: 12 or 23 h of light/d, and 2 digestible Trp levels: 2.6 or 5.2 g of L-Trp/kg of diet in pre-starter 1 from d 1 to d 14, and 2.4 or 4.8 g of L-Trp/kg of diet in pre-starter 2 from d 15 to d 24). The trial was carried out in a room with controlled temperature (26 and 23°C during the first 14 and during the last 10 d, respectively). Blood glucose was determined on d 0 and 24, and plasma cortisol on d 0 and 8. The baseline glucose and cortisol concentrations were used as a covariate adjustment in all analyses. No effects of light program and Trp levels interaction were observed on performance and blood glucose. From d 0 to 14 and 0 to 24, treatments did not influence ADG, ADFI and glucose, while G:F decreased ($P < 0.05$) from d 0 to 14 for pigs receiving 12 h of light/d compared with the ones receiving 23 h of light/d, but improvement was offset in the total period. Light program and Trp levels interaction was observed for plasma cortisol. Pigs receiving 23 h of light/d presented higher plasma cortisol ($P < 0.05$) than piglets receiving 12 h of light/d when fed diet with 2.6 g L-Trp/kg, however there was no difference on plasma cortisol ($P > 0.05$) in both light programs for pigs fed 5.2 g L-Trp/kg. In conclusion, higher levels of dietary Trp are recommended for piglets receiving light program of 23 h.

Key Words: cortisol, nursery pigs, photoperiod

M27 The effects of ethyl alcohol as a tool for pain management in neonatal pigs during castration.

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Castration without anesthesia is known to be a stressful procedure in neonatal pigs. The objective of this study was to examine the analgesic effects of ethyl alcohol (ETOH) during castration. Fifty boars across 14 litters (n = 14) were randomly assigned in a completely randomized design to 1 of 4 injection treatments: ETOH, Lidocaine, saline, or sham. One gilt from each litter was also selected as a handling control. At 3 days of age (doa), 1 ml of the respective treatment was injected into each testicle, and boars were castrated at 14 doa. Behaviors related to social cohesion, pain, and non-specific actions were continuously recorded in pens and during treatment injection and castration. Social cohesion behaviors identified how individuals acted in relation to the litter, pain-related behaviors quantified behaviors associated with pain, and non-specific behaviors signified general behaviors not associated

with pain. Body weight (BW) and testicular wound scores were recorded daily post-injection and post-castration. All data were analyzed with the use of a mixed effects model with treatment as a fixed effect and pen as a random effect. The frequency of pain-related behaviors post-injection was significantly increased in the ETOH and Lidocaine groups ($P < 0.05$), but these groups had lower behavioral frequencies than the saline and sham treatments post-castration ($P < 0.05$). There were no significant differences in the frequency of non-specific behaviors after injection ($P = 0.252$) or castration ($P = 0.456$). The frequency of social cohesion behaviors did not differ across groups post-injection, but all groups had significantly greater frequencies than gilts post-castration ($P < 0.05$). Pigs treated with ETOH had increased wound scores post-injection versus all groups ($P < 0.05$). Wound healing scores did not differ across treatments post-castration ($P = 0.37$) and BW did not differ across treatments overall ($P = 0.40$). Pigs treated with ETOH behaved similarly to Lidocaine-treated pigs, but further analyses are needed to determine the effectiveness of ETOH as a practical solution to address the pain and welfare concerns of castration in pigs.

Key Words: pig, castration, pain

M28 Effect of surgical and band castration on indicators of chronic pain in 0-, 2-, and 4-month-old beef calves.

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Three experiments were conducted to evaluate the effects of band and surgical castration on behavioral and physiological indicators of pain in beef calves at 3 different ages (36 calves/age group): newborn (Exp. 1, 4 ± 1.15 d of age, 43 ± 1.13 kg BW); 2 mo of age (Exp. 2, 63 ± 2.35 d of age, 92 ± 1.75 kg BW); or 4 mo of age (Exp. 3, 125 ± 4.65 d of age, 160 ± 3.36 kg BW). In each experiment calves were randomly assigned to sham (CT), band (BA) or surgical (SU) castration. Exp. 1, 2 and 3 ended when the testicles of banded calves had sloughed off (68, 49, and 42 d, respectively). Animal BW and rectal temperature were recorded weekly over the experimental period. Salivary cortisol, scrotal area temperature using infrared thermography, visual evaluation of swelling (5-point scale), and gait stride length was collected on d 1 and immediately before castration, and weekly thereafter until the end of the study. Hair samples were collected 1 d before and 28 d after castration, and at the end of the study for cortisol concentration. Standing and lying behavior was recorded over a 28-d period immediately after castration. At 4 mo of age, salivary cortisol concentration, scrotal area temperature, and stride length were greater ($P \leq 0.05$) in BA compared with CT calves, and lying time was lower ($P \leq 0.001$) in SU than CT calves. At 2 and 4 mo, hair cortisol tended to be greater ($P \leq 0.07$) in BA and SU compared with CT calves. The maximum degree of swelling ($P < 0.05$) caused by BA and SU was 1.5 at age 0; 3 and 3.5, respectively, at 2 mo; and 4.5 and 4, respectively, at 4 mo. At 2 and 4 mo of age swelling was observed between d 7 and 14 in SU, and between d 21 and 28 in BA. Newborn calves had maximum swelling between d 35 and d 42 in BA and between d 14 and d 21 for SU. Overall, band castration resulted in more chronic indicators of pain than surgical and sham methods. However, as calves got older, indicators of pain increased sequentially in band castrated calves.

Key Words: chronic pain, castration, beef calves

M29 Characteristics of agonistic behavior of commercially housed pigs after mixing. Shin-Jae Rhim*¹, Hyun-Su Hwang¹, Seung-Hun Son¹, Hojeong Kang¹, and Joon-Ki Hong², ¹*Chung-Ang University, Ansung, Gyeonggi, South Korea*, ²*National Institute of Animal Science, Cheonan, Chungnam, South Korea*.

This study was conducted to compare the aggressive behaviors of commercially housed pigs when mixed at different times after weaning. The behavioral patterns of 36 groups of pigs (a total of 360 animals) were observed by continuous monitoring over 3 consecutive days directly after weaning (25 ± 1.2 d of age), and 50 and 75 d with the aid of video technology. The pigs were not mixed previously and were same ages. The data were analyzed by ANOVA, Tukey's post hoc tests, and Wilcoxon rank-sum test using the SAS software. Fight latency and total duration and frequency of fighting were significantly different among the age groups. The agonistic behaviors decreased in 75-d old pigs if compared with 25- and 50-d-old animals. Moreover, dominance index (DI, DI was defined as the sum of wins minus defeats divided by the sum of wins, defeats, and stand-off outcomes) was higher in 25-d-old and lower in 75-d-old pigs. A comparison of dominant (DI >0) and submissive (DI <0) pigs showed significant differences ($P < 0.05$) for major aggressive behaviors in all age groups. Higher frequency and longer duration of aggressive interactions mean that dominant animals were more active than the submissive ones. Moreover, pigs with a positive dominance index initiated more fights ($P < 0.05$). Dominant pigs were involved in more aggressive interactions, had longer fights, and initiated more fights than submissive pigs. Moreover, older pigs have shorter fights after mixing and that they also sustain fewer injuries from these fights. Post-mixing aggressive behavior changed over time. Early experience of mixing in the rearing conditions might contribute to reduced aggressive behavior of growing pigs. It may have been occurred by more energetically efficiency strategy for stable social structure. This finding has potentially important consequences for animal welfare and economic production of commercial swine production.

Key Words: agonistic behavior, dominance index, interaction

M30 Determining feeder space requirement for growing-finishing pigs. Yuzhi Li*¹, Kimberly McDonalds², and Harold Gonyou², ¹*West Central Research and Outreach Center, University of Minnesota, Morris, MN*, ²*Prairie Swine Center Inc., Saskatoon, SK, Canada*.

A study was conducted to determine feeder space requirement for growing and finishing pigs based on the amount of time needed to maintain their feed intake and growth performance. The first trial used 16 pens of 12 pigs. Four pens were randomly assigned to each of 4 treatment combinations: mash diets fed from a dry feeder (DM), mash diets fed from a wet/dry feeder (WM), pelleted diets fed from a dry feeder (DP) and pelleted diets fed from a wet/dry feeder (WP). Both the dry and wet/dry feeder provided single feeding space and were similar in design. Eating behavior was video-recorded for 24 h in all pens when pigs were 35 to 45 kg and 90 to 100 kg, respectively. The videos were analyzed using scan-sampling at 5-min intervals to determine time spent eating for each size of pigs. In the second trial, 564 pigs in 32 pens were used to evaluate 4 levels (80%, 95%, 110%, and 125%) of feeder capacity for growing and finishing pigs, with 2 pens assigned to each level of feeder capacity under the same treatments. Feeder capacity was defined 100% when the feeder was expected to be used 100% of the time by pigs according to the eating behavioral data from trial one. The different levels of feeder capacity were generated by varying the number of

pigs in a pen and modifying the pen size accordingly to maintain floor space allowance consistent cross treatments. Pigs fed WM spent less time eating (72 vs. 107 min/pig/d for growers, SE = 2.68; $P < 0.001$) and 67 vs. 106 min/pig/d for finishers, SE = 3.39; $P < 0.001$) compared with pigs fed DM. Likewise, pigs fed DP spent less time eating than pigs fed DM ($P < 0.001$) during both growing and finishing phases. There was no difference in total duration of eating between pigs fed DP and WP. Cross treatments, ADG decreased from 793 to 693 g during the grower phase (SE = 9; $P < 0.001$) and from 941 to 667 g (SE = 27; $P < 0.001$) during the finishing phase when feeder capacity increased from 80 to 125%, respectively. To maintain 80% feeder capacity, the estimated feeder requirement is 11 pigs per feeder space for pigs fed DM during both growing and finishing phases. For pigs fed WM, DP or WP diets, the estimated feeder requirement is between 14 and 16 pigs for the growing phase, and between 17 and 18 pigs for the finishing phase.

Key Words: eating behavior, feeder space, pig

M31 Effects of different number of animals relative to a single feeding space on performance and behavior in Holstein bulls fed high-concentrate diets. Maria Devant*¹, Alex Bach^{2,1}, and Marçal Verdú¹, ¹*IRTA-Ruminant Production, Animal Nutrition, Management, and Welfare Research Group, Caldes Montbui, Spain*, ²*ICREA, Barcelona, Spain*.

One hundred and eight Holstein bulls (155 ± 2.0 kg BW and 121 ± 0.8 d age) were randomly allocated to one of 6 pens and assigned either in groups of 16 (Ratio16) or in groups of 20 (Ratio20) to a single space feeder with lateral protections. Each pen (6 m × 12 m) had also 1 straw feeder, and 1 drinker. Concentrate intake was recorded daily, straw consumption weekly, and BW fortnightly (total 15 periods). Animal behavior was registered every 28 d by scan sampling. Animals were slaughtered after 219 d and HCW and carcass quality recorded. Data were analyzed using a mixed-effects model with repeated measures. Mean concentrate intake (6.77 ± 0.168 kg/d), concentrate efficiency (0.22 ± 0.016 kg/kg), and carcass weight (271 ± 2.2 kg) were not affected by treatments. An interaction between treatment and time was observed in most of eating behavior parameters. During the growing (period 1 to 11) in Ratio16 bulls the number of visits to the feeder tended ($P = 0.08$) to increase, total daily time devoted to eat was greater ($P = 0.01$), whereas meal size ($P = 0.05$), meal duration ($P = 0.001$), and eating rate (period 5 to 11; $P = 0.001$) were lesser compared with Ratio20 bulls. However, at the end of the fattening period (periods 12 to 15) no differences between treatments were observed. In Ratio16, the percentage of animals drinking was greater ($P = 0.05$) compared with Ratio20. Moreover, an interaction between treatment and time was observed in the percentage of animals performing self-grooming ($P < 0.05$) and attempting to mount ($P = 0.10$). In conclusion, when the ratio of number of animals to a single feeder was reduced by 20%, the number of visits tended to increase, animals had shorter meals and meal sizes, and eating rate decreased; however, these differences were only observed during the growing period. These data may suggest that feeding space to animal ratio has an effect on eating behavior during the growing period, where social facilitation may be important. However, at the finishing as eating behavior becomes more individualized and/or animals learn to take turns, the feeding space to animal ratio is less critical.

Key Words: bulls, feeding space to animal ratio, eating behavior

M32 Effects of stocking density and source of forage fiber on short-term behavioral and lactational responses of Holstein dairy cows. Mackenzie A. Campbell^{1,2}, Kurt W. Cotanch¹, Catherine S. Ballard¹, Heather M. Dann¹, Dave M. Barbano³, Alyssa M. Couse¹, and Richard J. Grant¹, ¹William H. Miner Agricultural Research Institute, Chazy, NY, ²The University of Vermont, Department of Animal Science, Burlington, VT, ³Cornell University, Ithaca, NY.

Understanding the interaction of stocking density and diet is vital for the improvement of dairy cow well-being and productivity. Multiparous (n = 48) and primiparous (n = 20) Holstein cows were assigned to 1 of 4 pens (n = 17 cows/pen, based on previous response variability) to determine the short-term effects of stocking density and source of forage fiber on behavior and lactational performance. Pens were assigned to treatments in a 4 × 4 Latin square with 14-d periods using a 2 × 2 factorial arrangement. Two stocking densities (STKD; 100 or 142% of stalls and headlocks) and 2 diets (straw; S and no straw; NS) resulted in 4 treatments: 1) 100NS, 2) 100S, 3) 142NS, and 4) 142S. Dietary forage content consisted of 39.7% corn silage and 6.9% haycrop silage versus 39.7% corn silage, 2.3% haycrop silage, and 3.5% chopped straw (dry matter; DM basis) for NS and S, respectively. Both diets were formulated for 16% crude protein, 28% neutral detergent fiber (NDF), and 28% starch (DM basis). Alterations in forage fiber source resulted in physically effective NDF values of 18.8% and 20.1% for NS and S, respectively. Pen intake and milk yield were measured on d 8–14 of each period. Time spent feeding, ruminating, and lying were measured using 72-h direct observation on d 8–10 of each period. Milk component yields were quantified for 6 milkings on d 13 and 14 of each period. Data were analyzed using the MIXED procedure in SAS with pen as the experiment unit. Eating time (238 min/d, SEM = 4), rumination time (493 min/d, SEM = 9), and pen intake (25.3 kg/cow/d, SEM = 0.4) did not differ (*P* > 0.10) among treatments. Milk, true protein and lactose yields tended to decrease with S. Although higher STKD decreased lying time, diet had no effect. The dietary addition of straw had minimal effects on short-term production and behavioral responses at varying STKD.

Table 1 (Abstr. M32). Production of Holstein cows assigned to 2 stocking densities (STKD; 100 or 142% of stalls and headlocks) and 2 diets (straw; S and no straw; NS)

Item	100% STKD		142% STKD		SEM	P-value		
	NS	S	NS	S		STKD	Diet	STKD × Diet
Milk, kg/d	41.2	40.4	40.7	40.0	0.7	0.21	0.06	0.79
Fat, kg/d	1.29	1.30	1.30	1.25	0.02	0.48	0.12	0.08
True protein, kg/d	1.02	1.01	1.02	0.99	0.01	0.25	0.07	0.42
Lactose, kg/d	1.41	1.39	1.40	1.37	0.04	0.25	0.08	0.61
Lying, min/d	832	827	779	796	11	<0.01	0.56	0.31

Key Words: physically effective fiber, overcrowding

M33 Effect of temperament on feedlot performance and carcass traits in purebred and crossbred Nellore cattle. Aline C. Sant'Anna¹, Fernanda M. Benez², Janaina S. Braga², Arquimedes J. R. Pellechia², and Mateus J. R. Paranhos da Costa¹, ¹São Paulo State University, Department of Animal Science, Faculty of Agricultural

and Veterinarian Sciences, Jaboticabal, São Paulo, Brazil, ²São Paulo State University, Post Graduate Program in Animal Science, Faculty of Agricultural and Veterinarian Sciences, Jaboticabal, São Paulo, Brazil.

The aim of this study was to assess the effect of temperament on feedlot performance and carcass traits in Nellore and crossbred cattle (F₁ Angus × Nellore and Caracu × Nellore). A total of 450 bulls raised on pasture and finished in feedlot were kept in outdoor feedlot pens with 12 m², during 87 d of confinement. Cattle temperament was assessed using the crush test (REA, recording the movements and tension inside the crush in a 7-point scale); and the flight speed test (FS, m/s), measuring the speed at which the animals exited the crush, measured in the beginning (d 0, initial) and in the end of the feedlot period (final). Performance and carcass traits used were: final BW, ADG, hot carcass weight (HCW), carcass yielding (CY), subcutaneous fat score (SFS), number of bruises in the carcass (BRU) and ultimate meat pH (pH_{24h}). Linear mixed models were fitted to assess the effects FS and REA on dependent traits. Final FS affected (*P* < 0.05) BW and ADG, with an estimated reduction of 7.92 kg in BW and 0.13 kg/d in ADG for an additional unity in FS (Table 1). Final FS had significant effects on most of the carcass traits assessed, resulting in reduction of CW (*P* < 0.05), SFS (*P* < 0.01), and increased BRU (*P* < 0.05) and meat pH_{24h} (*P* > 0.05). Final REA affected only CY (*P* < 0.05). Initial FS and REA had less pronounced effects on performance traits, with initial FS effecting only BRU (*P* < 0.01), and initial REA affecting ADG (*P* < 0.05). We conclude that more excitable temperament (faster FS) may have negative effects on cattle feedlot performance, carcass traits and meat pH_{24h}. The FS assessed at the end of feedlot period was the best predictor of the detrimental effects of temperament on performance of Nellore and crossed cattle. Financial support: FAPESP (2013/20036–0).

Table 1 (Abstr. M33). Effects of initial and final flight speed (FS) and reactivity score (REA) on feedlot performance and carcass traits, expressed as regression slopes (β)

Trait	β FS initial	β REA initial	β FS final	β REA final
Final BW, kg	-4.58	-1.12	-7.92*	-0.91
ADG, kg/d	0.00	-0.05*	-0.13*	0.00
Carcass weight, kg	-1.70	-0.31	-6.23*	-1.52
Carcass yielding, %	0.23	-0.12	-0.10	-0.28*
Subcutaneous fat score	-0.29	-0.02	-0.66†	0.07
Bruises	0.25†	-0.01	0.22*	0.02
pH _{24h}	0.00	0.00	0.02*	0.00

**P* < 0.05; †*P* < 0.01.

Key Words: flight speed, reactivity, beef cattle

M34 Agitated temperament related to worse carcass quality in feedlot cattle. Désirée Ribeiro Soares¹, Karen S. Schwartzkopf-Genswein², Joslaine N. Dos Santos Gonçalves Cyrillo³, and Mateus J. Rodrigues Paranhos da Costa¹, ¹Faculdade de Ciências Agrárias e Veterinárias, UNESP, Jaboticabal, São Paulo, Brasil, ²Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge, Alberta, Canada, ³Centro APTA Bovinos de Corte, Instituto de Zootecnia, IZ, Sertãozinho, São Paulo, Brasil.

The aim of this study was to determine the influence of flight speed (a proxy for cattle temperament) on dry matter intake (DMI), residual feed intake (RFI), performance and carcass composition. A total of 284 bull Nellore calves (256.9 ± 26.5 d of age) were evaluated during 2 feed

efficiency tests in 2012 and 2013. Calves were housed over a period of 93 and 87 d, respectively, in 2 feedlot pens (41 m²·animal⁻¹·pen⁻¹), containing 8 feed troughs per pen equipped with a radio frequency system (GrowSafe System Ltd., Airdrie, AB, Canada) used to measure DMI (kg·d⁻¹), RFI (kg·d⁻¹) and feed conversion ratio (kg gain·kg DMI⁻¹). The diet was offered ad libitum, 3 times daily and consisted of corn silage, ground corn, soybean meal and mineral supplement. Calves were weighed every 14 d to calculate average daily gain (ADG; kg·d⁻¹) for each individual. Carcass composition was recorded using ultrasound between the 12th and 13th ribs, on the last day of the feeding period to obtain ribeye area (REA; cm²). Flight speed (FS; m·s⁻¹) was assessed every 28 d at the time of weighing. Calves were classified for temperament type according to their flight speed as follows: Calm = calves within the slowest tertile; Agitated = calves within the fastest tertile; and Intermediary = calves between the slowest and fastest tertile. Comparison of temperament type was analyzed with the PROC MIXED procedure (SAS Inst. Inc., Cary, NC). The model statement contained the effects of temperament class, feed efficiency test, and age on d 1 of the feeding period, as a covariate. No FS effect ($P > 0.05$) was observed on RFI and ADG; however, calves categorized as Agitated temperament had lower ($P < 0.05$) DMI (7.20 ± 0.09 , 7.40 ± 0.09 , and 7.16 ± 0.09 kg·d⁻¹) and REA (62.90 ± 0.71 , 62.05 ± 0.72 , and 60.69 ± 0.72 cm²) than Calm and Intermediary groups, respectively. Based on these results we conclude that Nellore cattle characterized as having agitated temperaments during handling, consumed less feed, and had worse carcass composition.

Key Words: behavior, confinement, reactivity

M35 Effects of handling before and during processing on behavior and ADG of feedlot steers. Ruth H. Woiwode*¹, Temple Grandin¹, Brett Kirch¹, and John Paterson², ¹Colorado State University, Fort Collins, CO, ²National Cattlemen's Beef Association, Centennial, CO.

The objective of this study was to investigate if a relationship exists between handling, and behavior and ADG of feedlot cattle. Upon arrival at a commercial feedlot in Kansas, Hereford steers ($n = 496$; initial BW = 304 ± 35.6 kg) of similar genetic background were sorted into 4 pens to determine the effects of handling on behavior and ADG. Two handling conditions before processing and 2 conditions of release from the squeeze chute were imposed. Prior to processing, handlers were required to quietly walk all steers from their home pen to the processing area (SLOW); or handlers were permitted to bring steers to the processing area in the normal fashion (FAST). Individual steers were randomly assigned to one of 2 conditions of release from the squeeze chute. The first was a delay no longer than 30 s following the completion of procedures to allow cattle to stop struggling (DELAY); the second was release immediately following the completion of procedures (NORM). Vocalization, chute temperament, exit speed and exit behavior scores were assigned to all steers during intake processing. Vocalization was scored on a yes/no basis, and was recorded before procedures. Temperament scores were assigned after head gate capture, on a 5-point scale (1 = calm, 2 = shifting; restless, 3 = squirming; shaking squeeze chute, 4 = continuous, vigorous movement, 5 = rearing, struggling violently). Exit

speed was scored on a 3-point scale (walk; trot; run), and exit behavior was scored on a 2 point scale with cattle classified as high or low on a reactivity scale (L = No behaviors other than exit speed, H = Stumble, rear, jump). Paired *t*-tests determined that cattle exiting the chute at a walk or trot vs. a run tended ($P = 0.08$) to have higher ADG. Cattle vocalizing during restraint had lower ($P = 0.04$) ADG than those that did not vocalize. The FAST group showed a tendency to vocalize more frequently than the SLOW group. Pearson correlation analysis showed a significant, positive correlation between exit speed and vocalization ($P = 0.0021$, $r = 0.14256$), and a significant, negative correlation between exit speed and ADG ($P = 0.0036$, $r = -0.13542$). Using this approach, handling was correlated with behavior and ADG.

Key Words: behavior, vocalization, ADG

M36 Temperament of beef cattle receiving supplementation on grazing system: daily gain, ultrasound measures, and intake behavior. C. L. Francisco*, A. M. Castilhos, D. C. M. Silva, F. M. Silva, and A. M. Jorge, Universidade Estadual Paulista-FMVZ, Botucatu, SP, Brazil.

A study was conducted to evaluate the temperament of beef cattle on grazing system regarding daily gain, ultrasound measures, and intake behavior. Twenty growing animals [Nellore; non-castrated males; 220 ± 3.73 kg initial body weight (BW); 10 \pm 1 mo of age] on rotational stocking system (*Brachiaria brizantha* 'Xaraés') were used. Animals were evaluated for BW and temperament at the beginning of the trial period. Individual temperament scores were calculated by averaging animal chute score and exit score [adequate (ADQ) ≤ 3 ; or excitable (EXC) > 3]. Animals were ranked by BW and assigned to receive ($n = 10$) or not (control = CON; $n = 10$) a supplementation treatment (SUP; 0.6% of BW; corn, urea and mineral salt). BW were measured on d 0 and d 84 to determine the total gain (TG) and average daily gain (ADG). Hip height (HH) and ultrasound evaluations (ribeye area; backfat thickness) were carried out on d 0 and 84. Intake behavior evaluations were obtained via direct observation (8 d; 24-h per day) with an interval of 15 min between observations (time of grazing, rumination, resting, and drinking water). Data were analyzed with PROC MIXED in SAS with fixed effects of temperament, treatment and the resultant interaction. No interaction was significant. ADQ animals had greater final BW ($P = 0.01$) and HH ($P = 0.01$) than EXC animals (310.78 vs. 273.06 kg for BW; 1.36 vs. 1.32 m for HH, for ADQ and EXC animals, respectively). SUP treatment had greater final BW ($P = 0.04$), TG ($P < 0.01$), ADG ($P < 0.01$), final ribeye area ($P < 0.01$), and HH ($P = 0.03$) than CON treatment (305.80 vs. 278.04 kg for BW; 79.60 vs. 57.43 kg for TG; 0.95 vs. 0.69 kg for ADG; 37.25 vs. 30.84 cm² for ribeye area; 1.35 vs. 1.32 m for HH, for SUP and CON treatments, respectively). For intake behavior outcomes, ADQ animals had greater time of rumination ($P = 0.01$) than EXC animals (456.30 vs. 440.31 min, for ADQ and EXC animals, respectively). In conclusion, some characteristics of performance and intake behavior are associated with temperament and it is independent of differences in supplementation treatment in Nellore cattle. Supported by FAPESP#2014/07406-5.

Key Words: Nellore cattle, pasture, temperament