

Monday, July 13, 2009

POSTER PRESENTATIONS

Animal Behavior and Well-Being

M1 Validation of footprint analysis to describe sow gait. J. Grégoire^{*1,2}, R. Bergeron³, S. D'Allaire⁴, M.-C. Meunier-Salaün⁵, and N. Devillers¹, ¹AAFC, Dairy and Swine R&D Centre, Sherbrooke, QC, Canada, ²University Laval, Ste Foy, QC, Canada, ³University of Guelph, Alfred, ON, Canada, ⁴University of Montreal, Faculty of Veterinary Medicine, St Hyacinthe, QC, Canada, ⁵INRA-SENAH, St-Gilles, France.

Locomotion disorders represent the second cause for culling breeding sows and affect up to 25% of sows and gilts. In order to study lameness, methods must be developed to objectively describe and assess sow gait and locomotion disorders. Five second-parity gestating sows were used in 3 trials per day over 2 days to validate the use of footprints to assess sow gait related to lameness. The method consisted of measuring footprints remaining after a sow was moved along a 4.9 m clay corridor. A digital panoramic photo of the footprint sequence was taken and analyzed with specialized software. Individual footprints were identified using a system which assigned a separate color to each leg. Footprints were accepted if the sow walked without stopping and had taken at least 3 strides. Footprints variables measured or calculated for assessment are shown in Table 1. Measurement variability was assessed for each sow. Spearman correlations were also calculated between each measure and the walking speed of sows. Speed was correlated with stride length ($r=0.50$, $P<0.01$) but not with other variables. Measurements from footprints are a promising tool to describe sow gait and quantify lameness. However, more data are needed to describe variations between sound and lame sows and to characterize locomotion disorders.

Table 1. Means and variability of measures on sow footprints

Distances	Mean (cm) [Range]	Intra-day CV% (Range)	Inter-day CV% (Range)
Contralateral	46 [36-55]	4-11	2-7
Ipsilateral front	58 [45-73]	4-11	3-10
Ipsilateral rear	31 [24-40]	7-16	1-2
Diagonal front	20 [11-27]	8-25	2-10
Diagonal rear	75 [68-85]	2-6	0.5-5
Stride length	88 [72-99]	2-7	2-7
Distance between fronts	15 [9-21]	2-31	3-19
Distance between rears	10 [5-14]	2-27	2-14
Surface area	327 cm ² [171-500]	2-47	0.5-21

Key Words: behavior, lameness, clay

M2 Changes of serum HSP70 during weaning and effects of NCG and arginine on serum HSP70 in early-weaned piglets. X. Wu, X. Zhou, Y. Gao, Y. Yin*, and R. Huang, *Laboratory of Animal Nutritional Physiology and Metabolic Process, Institute of Subtropical Agriculture, the Chinese Academy of Sciences, Changsha, China.*

Stress-induced heat shock protein 70 (HSP70) functions to promote refolding and prevent aggregation of partially-denatured proteins, as well

as tag irreversibly-damaged proteins for proteolysis to protect the cells in stress. L-Arginine is a nutritionally essential amino acid that is particularly important for piglets under stress conditions. N-Carbamylglutamate (NCG) is a metabolically stable analogue of N-acetylglutamate which activates a key enzyme in arginine synthesis in enterocytes. This study determined changes in serum HSP70 during weaning and the effects of N-Carbamylglutamate (NCG) and Arginine on serum HSP70 and TNF- α . On d 1, 2, 3, 5 and 7 after weaning, six piglets were selected after 12 hrs fasting on each day for blood sampling to evaluate serum HSP70 by ELISA. In another experiment, eighty-nine Landrace \times Yordshire piglets from 12 pens (average pen weight 5.56 \pm 0.51 kg; weaned at 21 d) were grouped into 3 treatments, and fed one of the following diets for 7 days: a standard diet (SD), SD+NCG (0.08%), or SD+Arg (0.6%). On 8 d after weaning, six piglets were randomly selected from each treatment for serum samples. Results were statistically analyzed using one-way ANOVA. Serum HSP70 increased after weaning, reaching its highest concentration of 2.17 μ g/mL on d 3 after weaning, and then decreased to 0.5 μ g/mL ($P<0.05$). Serum HSP70 was higher in the NCG and Arg groups than the control group ($P<0.05$). NCG increased serum TNF- α ($P=0.046$). These findings indicated that weaning induced HSP70 production in piglets. Arginine and NCG maintained serum HSP70 concentrations in terms of supporting HSP70 synthesis. In conclusion, Arginine and NCG alleviated weaning stress, stimulated changes in HSP70 and may be useful in diets.

Key Words: N-carbamylglutamate, L-arginine, HSP70

M3 Effects of feed-borne *Fusarium* mycotoxins on histological changes in lymphoid organs of turkeys. C. K. Girish*, T. K. Smith, P. Anil Kumar, and G. N. Girgis, *University of Guelph, Guelph, Ontario, Canada.*

An experiment was conducted to investigate the effects of feeding grains naturally contaminated with *Fusarium* mycotoxins on histology of lymphoid organs including bursa of Fabricius, thymus and spleen of turkeys. The efficacy of a polymeric glucomannan mycotoxin adsorbent (GMA) was also determined. Seventy-two 1-d-old male turkey poults were fed corn, wheat, and soybean meal-based diets for 21 days. Diets included (1) control grains, (2) contaminated grains and (3) contaminated grains + 0.2% GMA. The major contaminant was deoxynivalenol (2.7-3.6 μ g/g) with lesser amounts of zearalenone (0.67-0.75 μ g/g) and 15-acetyldeoxynivalenol (0.26-0.31 μ g/g). Histological changes were recorded at the end of 14 and 21 days of feeding. Data were subjected to arcsine transformation and analyzed by analysis of variance using a PROC GLM procedure of SAS. Histological examination of bursa and thymus revealed that the proportion of birds showing lymphocytolysis was numerically higher in the birds fed naturally contaminated diets compared to controls on both day 14 (0.46 vs 0, bursa; 0.78 vs 0.15, thymus) and 21 (0.39 vs 0, bursa; 0.23 vs 0, thymus). The feeding of contaminated diets significantly ($P=0.003$) increased secondary follicles in spleen at the end of day 21 compared to controls. Lymphocytolysis as observed in bursa of Fabricius and thymus after feeding contaminated diets could result in immunosuppression. The formation of secondary follicles in the spleen could be attributable to an acute immune response to the feeding of naturally contaminated grains. It can be concluded

that the feeding of contaminated grains resulted in altered cellularity of lymphoid organs. The feeding of naturally contaminated grains to turkeys should be minimized.

Key Words: *Fusarium* mycotoxin, histology, lymphoid organs

M4 Seasonal cow behavior in a large dairy herd in central Iran.

R. Kowsar¹, A. Nikkhah*^{2,1}, M. Khorvash¹, M. Alikhani¹, and G. R. Ghorbani¹, ¹*Isfahan University of Technology, Isfahan, Iran*, ²*Zanjan University, Zanjan, Iran*.

Monitoring behavior helps to optimize nutritional, health, and social states of high-producing cows in mechanized and competitive environments. A study was conducted between December 2006 and February 2008 to determine seasonal eating, ruminating, and lying behaviors of dairy cows of different age and productivity. The herd had about 3000 dairy cattle housed in yards. A total of 415 multiparous, high-producing cows (MH), 166 multiparous, medium-producing cows (MM), 166 multiparous, low-producing cows (ML), 165 primiparous, high-producing cows (PH), 83 fresh cows (FC), 82 fresh heifers (FH), and 82 high milk somatic cell counts (HSCC) cows were monitored. The average daily air temperature and relative humidity were 2.53°C and 55.8% in Winter, 20.9°C and 36% in Spring, 26.8°C and 17.3% in Summer and 10.0°C and 43.9% in Fall. During each season, eating, ruminating, standing and lying behaviors were recorded weekly and on multiple days within weeks at 1000 h by 4 individuals. Each activity was expressed as the percentage of cows exhibiting the activity relative to the existing number of cows at each recording day. Across groups, a greater percentage of cows ($P < 0.01$) were eating during Winter (25.7%) than during Spring (17.1%), Summer (15.4%), and Fall (14.5%). The percentage of cows neither eating nor ruminating was less ($P < 0.05$) in Winter (48.1%) than in Summer (58.9%) and Fall (58.6%) but not in Spring (53.7%). More cows in PH (24.6%) and ML (21.3%) groups were observed eating than in MM (15.2%), MH (16.6%), and FC (12.3%) groups. Lying was observed more often ($P < 0.01$) in FC (71%), MM (69.6%) and MH (64%) cows than in FH (54%), ML (55.7%) and PH (55.7%) groups. More cows were seen ruminating ($P < 0.01$) in MM (31.7%), FC (31.3%), HSCC (28.7%), PH (27.2%) and MH (26.7%) groups compared to FH (20.5%) and ML (22.9%) groups. The HSCC cows did not behave in ways that would distinguish them from cows with normal milk SCC. In the light of the large sample size and prolonged experimental period, findings demonstrate significant effects of season, age, lactation stage, and production level on eating, ruminating, and lying behaviors of dairy cows.

Key Words: eating, behavior, season

M5 Automated recording of sow posture and locomotion using accelerometers.

N. Devillers*¹, J. Déom^{1,2}, C. Corriveau¹, J. Grégoire^{1,3}, and R. Bergeron⁴, ¹*AAFC, Dairy and Swine R&D Centre, Sherbrooke, QC, Canada*, ²*University of Sherbrooke, Sherbrooke, QC, Canada*, ³*University Laval, Ste Foy, QC, Canada*, ⁴*University of Guelph, Alfred, ON, Canada*.

The aim of this study was to assess the efficacy of an alternative, automated technique to measure posture and locomotion. Accelerometers (HOBO® G Logger UA-004-64, Onset®, Pocasset, MA) were installed on the rear leg and back (between shoulder blades) of 11 sows, housed either in gestating stalls ($n=3$), individual gestating pens ($n=4$) or farrowing crates ($n=4$). The accelerometer measured its relative position in

a 3D-space every 5 sec and provided angle data for the 3 axes. Optimal angle range was determined as the one giving the best percentage of agreement between video observations of postures and calculation from accelerometer data for a 6-hour period. However, optimal angle ranges for each posture varied between sows, and when adapted to fit each sow, the percentage of agreement between accelerometers and video observations averaged $98.0 \pm 0.6\%$. An overall percentage of agreement of $91.0 \pm 3.4\%$ was obtained when an optimal angle range that could fit all sows was used. The percentages of agreement for each posture and for all sows were $79.1 \pm 6.3\%$, $89.0 \pm 4.4\%$, $82.5 \pm 4.2\%$ and $99.1 \pm 0.3\%$ for lying laterally, lying ventrally, sitting and standing, respectively. Rear leg accelerometers were also used to record accelerations on the vertical axis 5 times per sec on 2 sows during 10 and 20 min eating periods. Numbers of steps/10 sec were calculated from variations in accelerations. Steps for each leg of the sow were also counted by video observation. Total number of steps for all legs was correlated to the number of steps for the measured leg ($r=0.78$, $P < 0.01$). Number of steps measured from acceleration and from video observation were highly correlated ($r=0.98$, $P < 0.01$). Finally, precision of step counting was 0.03 steps/10 sec. In conclusion, accelerometers are efficient and precise devices to automate posture and locomotion recording in sows, but calibration is necessary for posture measurement.

Key Words: behavior, technique, posture

M6 The effects of farm-to-slaughter plant pig management on pork quality.

L. N. Edwards*¹, T. Grandin¹, T. E. Engle¹, M. J. Ritter², A. Sosnicki³, and D. B. Anderson¹, ¹*Colorado State University, Fort Collins*, ²*Elanco Animal Health, Greenfield, IN*, ³*PIC, Hendersonville, TN*.

Two studies differing in facility design and season (Exp. 1 & 2) were conducted to determine effects of pre-slaughter management on pork quality by monitoring blood lactate concentration ([LAC]) and rectal temperature TEMP throughout the marketing process, from loading at the farm to exsanguination. (Exp.1, $n = 80$; Exp. 2, $n = 144$). Blood lactate concentration and TEMP were sampled from each animal at seven points during the marketing process: (1) baseline at the farm, (2) post-loading on the truck, (3) pre-unloading after transport, (4) post-unloading at the plant, (5) post-lairage at the plant, (6) post-movement to the stunning area and (7) at exsanguination. Pearson correlations were used to determine relationships between [LAC] and TEMP at the seven sampling points and meat quality. Correlations were also used to relate the changes in [LAC] and TEMP between sampling points to meat quality. Increased [LAC] during loading at the farm resulted in improved meat quality, i.e. increased 24 hr pH ($P < 0.002$), decreased L* ($P < 0.03$) and decreased drip loss ($P < 0.02$) (Exp. 1 & 2). Exsanguination [LAC] was not related to ultimate meat quality (Exp. 1 & 2) even though previous work has demonstrated that higher exsanguination [LAC] is related to lower 45 min pH and increased drip loss. It is hypothesized that these results are due to calm handling in the stunning chute preventing excessive [LAC] production by the skeletal muscles at exsanguination. Also there was a correlation between [LAC] at loading and [LAC] at exsanguination ($P < 0.002$, Exp. 2) suggesting that animals with high [LAC] at loading tended to maintain a high [LAC] at exsanguination. The data suggest that high [LAC] during loading is associated with higher ultimate pH, darker color, and lower drip loss. Therefore, improving pre-slaughter handling at the farm during loading will not necessarily translate to direct improvements in fresh pork quality traits.

Key Words: drip loss, handling, pre-slaughter

M7 Comparison of slaughter methods with or without previous stunning on animal welfare and bleeding efficiency in bulls. J. E. Gomes Neves¹, M. J. R. Paranhos da Costa¹, R. Roça², N. G. Gregory³, and L. Faucitano^{*4}, ¹Faculdade de Ciências Agrárias e Veterinárias, Universidade Estadual Paulista Julio de Mesquita Filho, Jaboticabal, Sao Paulo, Brazil, ²Faculdade de Medicina Veterinária e Zootecnia, Universidade Estadual Paulista Julio de Mesquita Filho, Botucatu, Sao Paulo, Brazil, ³Royal Veterinary College, London, UK, ⁴Agriculture and Agri-Food Canada, Sherbrooke, Canada.

In Brazil, steers are mainly slaughtered by captive bolt stunning (with or without bolt penetration) and bleeding. However, in some plants religious slaughter consisting of bleeding without previous stunning is also used. Religious slaughter without stunning is criticized from an animal welfare standpoint. The objective of this study was to assess the effects of two slaughter methods (with vs without previous stunning) on brainstem function of steers during bleeding and bleeding efficiency. A total of 171 Nelore (pure and crossbred) bulls weighing 287 kg on average were either stunned using a penetrating captive bolt (A1; 84 bulls) or were not stunned (A2; 87 bulls) prior to slaughter. Brainstem function was evaluated at 20 and 60 sec after bleeding using parameters such as palpebral and corneal reflex, rhythmic breathing and response to potentially painful stimuli (nose and tongue pricking/pinching). Bleeding efficiency was assessed through the analysis of residual haemoglobin content in the Longus colli muscle. Signs of consciousness data were analysed by Fisher test, while bleeding efficiency data were analysed by Wilcoxon test. No A1 bulls showed signs of brainstem function or pain responsiveness during bleeding, while 98 and 54% of A2 bulls were showing one or more of these signs at 20 and 60 sec after bleeding, respectively ($P < 0.001$). No difference in bleeding efficiency was observed between slaughter treatments. In conclusion, religious slaughter as it was implemented in this study was less appropriate from an animal welfare point of view and captive bolt stunning appears to be better practice if one wants to make sure animals are unconscious while bleeding.

Key Words: beef, slaughter, animal welfare

M8 Water access and the physiological well-being of Holstein slaughter cows. K. D. Vogel^{*1}, J. R. Claus², T. Grandin¹, G. R. Oetzel³, and D. M. Schaefer², ¹Colorado State University, Fort Collins, ²University of Wisconsin, Madison, ³University of Wisconsin, Madison.

The objective of this study was to investigate the impact of water access on the physiological well-being of Holstein slaughter cows during marketing through analysis of serum components and body weight. Multiparous Holstein cows ($n = 57$, 613 ± 88 kg mean body weight, 2.9 ± 0.5 mean BCS, varying stage of lactation) were purchased from a Wisconsin terminal market and assigned to two water withdrawal treatments (Control, free access to water at all times; 36 h, 36 hours of continuous water withdrawal) following a completely randomized block design. Blood samples were collected by tail vein puncture at 0, 9, 18, 27, and 36 h of each treatment. Mean ambient temperatures were $1.9 \pm 6.2^\circ\text{C}$ during the trial period, which occurred in March and April. Mean serum glucose was greater ($P < 0.05$) with the 36 h treatment (79.09 ± 1.13 mg/dl) than the control (75.37 ± 1.13 mg/dl). Mean serum creatinine was greater ($P < 0.05$) with the 36 h treatment (0.61 ± 0.03 mg/dl) than the control (0.69 ± 0.03 mg/dl). Lack of water access for 36 h also increased ($P < 0.05$) mean serum albumin, anion gap, calcium, chloride, sodium, and urea N. Mean body weight loss increased between 0 and 36 h, regardless of water access treatment. Greater ($P < 0.05$) mean total body weight loss was observed in the 36

h treatment ($5.16 \pm 0.40\%$) when compared with the control treatment ($3.27 \pm 0.40\%$). As sampling time increased from 0 to 36 h, regardless of water access treatment, mean serum total bilirubin, anion gap, and phosphorus increased. Mean serum bicarbonate decreased ($P < 0.05$) between the 18 h (27.74 ± 0.47 mmol/l) and 36 h (25.59 ± 0.47 mmol/l) sampling times. In conclusion, it was determined that water withdrawal in lairage should not exceed 18 h to prevent unnecessary weight loss during the marketing of Holstein slaughter cows under climatic conditions similar to those in this study.

Key Words: dairy cow, Holstein, welfare

M9 Changes in temperament score as a result of handling do not affect voluntary feed intake. T. D. Maddock^{*1}, J. L. Foster¹, M. A. Elzo², and G. C. Lamb¹, ¹North Florida Research and Education Center, Marianna, ²University of Florida, Gainesville.

Beef cattle (bulls = 240, steers = 432, heifers = 641) were evaluated post-weaning for temperament and individual daily feed intake using a GrowSafe feed intake facility. Data were collected over a 4-yr period from 2005-2008. Cattle were weaned, inoculated for respiratory disease, and introduced to feed prior to entering the feeding facility. Cattle were assigned to pen (10 to 20 hd/pen) and acclimated to the feeding facility and diets for 14 d prior to initiation of a 70 d data collection period. Temperament scores were collected both objectively (exit velocity; m/s) and subjectively (chute score; 1 = very docile; 5 = very aggressive). During data collection cattle were handled either weekly (11x; $n = 307$) or every 2 wk (6x; $n = 1006$) and temperament scores were collected every two weeks (d 0, 14, 28, 42, 56, and 70) regardless of number of times handled. Independent variables were calf sex and working frequency; whereas, dependent variables measured were changes in exit velocity and chute scores. Temperament improved from d 0 to 70 with reductions in both chute scores (2.81 to 2.58; $P < 0.001$) and exit velocities (2.71 to 2.11 m/s; $P < 0.001$). Handling frequency did not affect differences in chute scores ($P = 0.11$), but cattle that were handled 6x (-0.68 m/s) had a greater reduction ($P < 0.001$) in exit velocity than cattle handled 11x (-0.08 m/s). Steers had a greater ($P < 0.01$) reduction in chute score (-0.35 m/s) than heifers (-0.17 m/s) and bulls (-0.05 m/s); however steers and heifers had similar ($P = 0.90$) reductions in exit velocity (-0.63 and -0.60 m/s, respectively) which were greater ($P < 0.01$) than bulls (-0.39 m/s). Feed intake (% of BW) was not correlated to improvements in chute score ($P = 0.12$) or exit velocity ($P = 0.94$). As cattle were handled, temperament improvement was partially dependent upon sex and handling frequency, however the improvements in temperament failed to enhance feed intake.

Key Words: beef cattle, feed intake, temperament

M10 Effect of group change on lying time and milk yield of dairy cattle. I. Guasch^{*1} and A. Bach^{1,2}, ¹IRTA-Ruminant Production, Caldes de Montbui, Spain, ²ICREA, Barcelona, Spain.

It is commonly believed that changing dairy cattle from groups results in social stress which may alter behavior and production performance. Forty-six (19 primiparous (PM) and 27 multiparous (MP)) lactating cows (milk yield = 38 ± 8 kg/d) were monitored over a 48-d period to assess the effects of introducing a group change in lying behavior and milk production. After calving all animals were moved to a pen holding approximately 50 cows. When cows reached about 60 DIM were moved (in sets of 3-9 animals) to a different pen holding about 120 cows. During the study 26 cows changed groups. Individual daily milk production

was recorded electronically. Total daily lying time and number of lying bouts were also automatically recorded using a pedometer (Afikim, Israel). The accuracy of the automatically-collected lying behavior data was validated comparing the results from the pedometers with those acquired through video recordings of 3 animals for two 3-d periods. Comparisons between PM an MP cows and the effect of group change were analyzed using a mixed-effects model including animal as a random effect. Overall, PM cows spent less ($P < 0.05$) time lying (624 ± 4.9 min/d) than MP cows (651 ± 3.8 min/d), but they showed a greater ($P < 0.05$) daily number of lying bouts (14 ± 0.2 bouts/d) than MP cows (11 ± 0.1 bouts/d). Average daily lying time the first 3 d after a group change was reduced ($P < 0.05$) to 562 ± 25.9 min/d from 651 ± 25.9 min/d prior the change. This change in lying time tended ($P = 0.08$) to be more marked in PM (-116 min/d) than in MP cows (-31 min/d). However, average daily lying time between 4 and 6 d after the group change increased to 594 ± 28.8 min/d and to 600 ± 28.1 min/d between 7 and 10 d thereafter. The average number of lying bouts was unaffected by group change. Daily average milk production tended ($P = 0.06$) to be reduced by 0.8 kg/d during the 3 d following the group change, with this reduction being more marked ($P < 0.05$) in PM than in MP cows. It is concluded that when animals change pens in groups of 3 or more, the consequences on lying time and milk production are transient and relatively short, but tend to be more pronounced in PM than in MP cows.

Key Words: social, monitor, management

M11 Effect of rubber flooring in a freestall dairy barn on cow behavior and milk production. J. Pempek* and N. Botheras, *The Ohio State University, Columbus.*

Most dairy cows in the United States are housed on concrete floors, which has likely contributed to an increased incidence of hoof problems and lameness. The use of alternative flooring surfaces that should provide a soft and slip-resistant surface for cattle has recently been debated in the dairy industry. This study investigated the effects of rubber versus concrete flooring on dairy cow behavior and milk production. Six pens were included in this study. Three experimental pens were covered with interlocking rubber mats and the other pens remained solid concrete. Primiparous cows were randomly allocated into two groups and placed on concrete or rubber flooring. Older cows were blocked based on their level of milk production (high versus low producing) and cows within each block were randomly allocated to pens with different flooring surfaces. Thirty-six cows were observed (six focal cows from each pen) for a continuous period of 24 h every 4 wk for 7 mo. Every 15 min, the location, posture and behavior of each focal cow were observed and recorded. Cows were milked twice daily and milk yields of focal cows at each milking were obtained. Over a 24 h period, there was no significant difference in the percentage of time spent feeding between the cows housed on a concrete surface and those on a rubber surface (LSM \pm SE: Concrete = $17.6 \pm 0.01\%$; Rubber = $17.1 \pm 0.01\%$; $P = 0.57$). Cows spent similar time lying in the freestalls (Concrete = $44.8 \pm 0.03\%$; Rubber = $42.9 \pm 0.02\%$; $P = 0.21$). Also, cows spent a comparable amount of time standing in the freestalls (Concrete = $17.8 \pm 0.03\%$; Rubber = $18.1 \pm 0.03\%$; $P = 0.20$) and standing anywhere in the pen while they were not feeding (Concrete = $19.0 \pm 0.02\%$; Rubber = $22.2 \pm 0.02\%$; $P = 0.71$). There was no significant difference in the milk yield of cows housed on concrete surfaces compared to cows housed on rubber surfaces (Concrete = 32.7 ± 1.54 kg/d; Rubber = 33.4 ± 1.38 kg/d; $P = 0.25$). In conclusion, a softer rubber flooring surface did not affect the behavior and milk yield of dairy cows.

Key Words: dairy cows, flooring, behavior

M13 Assessing within- and between-herd variation in lying behavior of dairy cows. K. Ito*, D. M. Weary, and M. A. G. von Keyserlingk, *Animal Welfare Program, University of British Columbia, Vancouver, BC, Canada.*

One of the most important design criteria for dairy cow housing is access to a comfortable lying area. Behaviors such as the time cows spend lying down and how often they lie down can be used to evaluate the quality of stalls; however, assessing lying behavior on farms can be challenging. Indices such as the Cow Comfort Index (CCI) and Stall Use Index (SUI) have been widely used in on-farm assessments. Our objectives were to establish reliable sampling and recording methods for measuring lying behavior, evaluate the adequacy of CCI and SUI as estimates for lying behavior, and to describe variation in the lying behaviors of freestall-housed dairy cows. Electronic data loggers recorded daily lying time and number of bouts at 1-min intervals for 5d for 2033 cows on 43 farms. CCI and SUI were calculated based on a single scan at 2h before pm milking on each farm. Subsets of data were created including 4, 3, 2 or 1d/cow and 40, 30, 20, 10, 5, or 1 cow(s)/farm. The estimate derived from each sample size was compared with the grand mean (5d and 44 cows/farm) for lying time and bouts, and CCI and SUI were compared to the farm mean lying time, bouts, and bout duration, using regression. Recording 30 cows for 3d represented the grand means with high accuracy ($R^2=0.9$), but using fewer cows or fewer d/cow resulted in poorer estimates of the farm average. CCI and SUI showed no association with the daily lying time ($R^2 < 0.01$, $P > 0.5$), and CCI was only weakly associated with the number of bouts ($R^2=0.16$, $P=0.01$) and bout duration ($R^2=0.09$, $P=0.05$), suggesting that these indices should not be used as indicators of lying behavior. Cows lay down on average (\pm SD) 11.0 ± 2.1 h/d in 9 ± 3 bouts, with the average bout duration of 87.7 ± 29.7 min. These values ranged from 9.5 to 12.9 h/d, 7 to 10 bouts/d, and 65.3 to 112.3 min/bout across farm means, and 4.2 to 19.5 h/d, 1 to 28 bouts/d, and 21.6 to 342.4 min/bout across individuals, showing that variation in lying behavior among individual cows within farm was far greater than differences across farms.

Key Words: dairy cow, lying behavior, cow comfort index

M14 Effects of pair versus single housing on behavior and performance of dairy calves before and after weaning from milk. A. De Paula Vieira*^{1,2}, M. A. G. von Keyserlingk¹, and D. M. Weary¹, ¹*University of British Columbia, Vancouver, BC, Canada*, ²*Capes Foundation, Brasilia, DF, Brazil.*

This experiment tested the effects of pair versus single housing on the behavior and performance of dairy calves before and after weaning. Calves were assigned to either continued individual housing ($n=9$ calves) or pair housing ($n=9$ pairs). Before weaning calves had ad libitum access to grain, hay and water via buckets. Pasteurized whole milk was fed via a teat twice daily for 2 h until d 37. During this period pair-housed calves ate more grain than the individually housed calves (averaging 93 vs. 59 ± 11 g/d; $P < 0.04$). Calves were weaned from milk starting on d 37 until d 42 by progressive dilution with water. From d 42 until d 49 only water was available from the teat and grain intake increased over this period (from 537 to 1.216 ± 91 g/d; $P < 0.0001$). From d 49 onward the teat was no longer available. Paired calves increased their intake of water from the bucket more rapidly than did the individual calves ($P < 0.02$). Intake averaged 1.73 vs. 1.53 ± 0.53 kg/d on d 49 and 6.08 vs. 3.74 ± 0.53 kg/d on d 50. Calves in both treatments vocalized in response to the teat removal on d 49, but this response was less in the paired than the individually housed calves (85 vs. 194 ± 9 calls/4 h period on d 49; $P < 0.0001$); call rate declined in both treatments to 3

vs. 13 ± 9 calls/4 h period on d 55 ($P < 0.0001$). There was no effect of treatment on calf BW from d 1 to d 55. On d 56, calves were moved to group pens, mixed with other calves and observed for 15 d; grain, water and hay were available ad libitum via automatic feeders. After mixing, paired calves spent more time at the feeder than did the individual calves (88 vs. 66 ± 3 min/d; $P < 0.004$). Similarly, paired calves consumed more grain (3.46 vs. 2.29 ± 0.17 kg/d; $P < 0.006$). Both differences were greatest on the d of mixing. Weight gains after mixing were higher for paired than individual calves (e.g. 0.02 vs. -2.40 ± 0.57 kg/d on the d after mixing; $P < 0.0002$); after 5 d, gain in the 2 groups were similar, averaging 0.45 kg/d. The results indicate that pairing calves minimizes behavioural responses and improves performance of dairy calves before and after weaning.

Key Words: social behavior, group housing, calf management

M15 Flavors affect the feeding behaviour of ewes fed two unpalatable feeds. A. Mereu¹, V. Giovanetti², G. Molle², I. Ipharraguerre³, and A. Cannas^{*1}, ¹Dipartimento di Scienze Zootecniche, University of Sassari, Sassari, Sardinia, Italy, ²Agris Sardegna, DiRPA, Olmedo, Sardinia, Italy, ³LUCTA SA, Barcelona, Spain.

In a previous experiment canola meal and oat grains resulted very unpalatable to ewes. The objective of this study was to enhance the acceptability by ewes of these two feeds through the addition of flavors. In a first experiment (Exp 1), the palatability of canola meal fed alone (control) or combined with 13 different flavors, formulated to elicit sweet (1 to 8), umami (9 to 12) or bitter (13) taste, was tested. A second experiment (Exp 2) resembled the first one except that oat meal instead of canola meal was used. In each experiment, one hour after being fed a basal diet (grass hay, barley meal and urea) each ewe entered alone a pen in which 200 g of a feed + flavor combination were supplied for 6 min. Then, the ewe was taken out and a new one tested another combination. The same 14 multiparous dry ewes were used for the two experiments, carried out in sequence with a 2-w resting period, following 14 (days/animals) x 14 (feed combination) Latin square designs. The statistical model included 3 fixed factors (feed combination, day, ewe). In Exp 1, the DMI of canola meal flavored with products 12 and 2 was higher ($P < 0.05$) than that of canola meal flavored with products 6 and 9. However, none of the treatments was significantly different from the control (only canola meal). There was a significant ($P < 0.05$) and positive relationship between DMI and experimental days for all treatments, except for treatment 12. For several treatments (5, 7, 8, 4 and 9 in decreasing order), mostly sweet-based additives, this association was very high, ranging from $R^2 = 0.85$ ($P < 0.001$) found for flavor 5 to $R^2 = 0.69$ ($P < 0.01$) for flavor 9. In Exp 2 (oat meal based), no differences in DMI among treatments were observed. The day effect was significant

for fewer treatments (in decreasing order of association: 6, 3, 1, 2, 5, 4, 12, control, and 8). The R^2 ranged from 0.50 ($P < 0.05$) to 0.26 ($P < 0.09$) for treatments 6 and 8, respectively. The experiments showed that some flavors (mostly sweet-based flavors) favored the adaptation of the animals to initially unpalatable feeds, reducing the variability of DMI among ewes.

Key Words: canola meal palatability, oat meal palatability, flavors

M16 When and where do cows defecate? M. Villettaz Robichaud^{*1}, A. M. de Passillé², and J. Rushen², ¹Université Laval, Québec, Québec, Canada, ²Agriculture and Agri-Food Canada, Agassiz, British Columbia, Canada.

Many environmental and animal health problems of dairy production are due to accumulation of feces but little research has been done on cow defecation and urination in the past fifty years. In exp. 1, we observed each occurrence of defecation and urination of 48 lactating Holstein cows (DIM = 144.7 ± 38.0 d., BW = 667.1 ± 72.0 kg, parity = 2.8 ± 2.3) in free-stalls over a period of 48h. There were large differences between cows in frequency of defecation (mean \pm SD, range; 10.0 ± 4.17 /d, 3–20/d) and urination (7.58 ± 3.21 /d, 2–18/d) and these were positively correlated ($r = 0.39$ $P = 0.01$). The frequency of urination and defecation were not strongly correlated with parity ($r = -0.13$ $P = 0.37$; $r = -0.27$ $P = 0.06$), milk production ($r = -0.03$ $P = 0.83$; $r = -0.16$ $P = 0.29$), body weight ($r = 0.14$ $P = 0.33$; $r = -0.01$ $P = 0.97$) and DIM ($r = -0.05$ $P = 0.76$; $r = 0.34$ $P = 0.02$). We observed 27.8% of defecation and 19.1% of urination in the area behind the stalls, occurred, 33.4% and 28.3% respectively in the feeding area and 20.7% and 38.4% when cows were standing with two feet in the stall and two feet in the alley. In exp. 2, we tested ways of stimulating defecation and urination. Twelve lactating Holstein cows were walked through a) an empty footbath or b) a footbath filled with water once a day for 6d. Cows were more likely to defecate in the water filled footbath (mean \pm SE 0.67 ± 0.08 vs 0.42 ± 0.08). However when repeated 23d later, there was no difference between the treatments. In further tests, the cows stood for 2 min. in a) a dry footbath, b) a footbath filled with still water, c) a footbath filled with running water, or had d) air or e) water sprayed over their legs. There were no significant effects of treatments. Defecation frequency during tests decreased from d1 to d29 (mean \pm SD d1 0.50 ± 0.52 , d29 0.08 ± 0.29). Large differences between cows in the frequency of defecation and urination suggest that some are disproportionately responsible for spreading manure throughout the barn. The frequency of defecation and urination are not strongly related to production traits. A better understanding of factors controlling defecation and urination may help in developing more effective cleaning routines.

Key Words: elimination, defecation, urination

Animal Health: Stress, Respiratory Disease, Small Ruminants

M17 Effects of dehydration and rehydration on the thermoregulation of heat stressed Angus steers. B. Scharf*, L. E. Wax, T. J. Evans, and D. E. Spiers, University of Missouri, Columbia.

Evaporative cooling via panting or sweating is the most effective means of maintaining core temperature of cattle exposed to heat for an extended period. Water restriction during heat stress alters this ability. Therefore, a study was conducted to determine if dehydration under a controlled heat challenge would compromise thermoregulation. Eight Angus steers were

maintained for 5 days at thermoneutrality (TN; 19–21°C) in the Brody Environmental Center (University of Missouri). This was followed by 14 days of cyclic heat stress (HS; 26–36°C). Water was removed starting on Day 5 of heat stress. After 3 days, water was returned starting the rehydration phase. Measurements included rectal temperature (Tre) and respiration rate (RR) measured six times daily. Body weight, feed and water intakes, and sweat rate at rump and shoulder were recorded daily during acclimation, dehydration and rehydration. During dehydration,