

Animal Behavior and Well-Being I

W140 The effect of feeding competition on pre- and postweaning performance of dairy calves. E. K. Miller-Cushon^{*1}, R. Bergeron², K. E. Leslie³, G. J. Mason⁴, and T. J. DeVries¹, ¹*Department of Animal and Poultry Science, University of Guelph, Kemptville Campus, Kemptville, ON, Canada*, ²*Department of Animal and Poultry Science, University of Guelph, Campus d'Alfred, Alfred, ON, Canada*, ³*Department of Population Medicine, University of Guelph, Guelph, ON, Canada*, ⁴*Department of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada*.

This study examined how reduced access to teats and feed buckets during the milk-feeding stage affects preweaning performance and postweaning response to competition for feed. Twenty Holstein bull calves were housed in pairs and provided milk replacer (MR) and starter ad libitum via either (1) 2 teats and 2 feed buckets/pen (non-competitive feeding; NCF), or (2) 1 teat and 1 feed bucket (competitive feeding; CF). Weaning occurred in wk 7 through incremental dilution of MR from 150 g/L to 0 g/L. Postweaning, calves were provided a complete pelleted diet and followed for 6 wk. In wk 8, 9, 12, and 13, all pens were fed noncompetitively via 2 feed buckets/pen. In wk 10 and 11, pens were fed competitively with 1 bucket/pen. Intake was recorded daily and calves were weighed 2×/wk. Data were analyzed in a repeated measures general linear mixed model. MR intake was subject to a treatment by week interaction ($P < 0.001$); NCF pens had initially greater intake (wk 2, 9.6 vs. 8.3 L/calf/d; SE = 0.6) and CF pens increased intake in later weeks (wk 5, 13.4 vs. 11.7 L/calf/d; SE = 0.3). Correspondingly, ADG evolved differently over time ($P = 0.003$), but BW was similar at weaning (103.6 kg; SE = 3.9; $P = 0.9$). Solid feed intake was greater for NCF pens before weaning (0.15 vs. 0.12 kg/d; SE = 0.01; $P = 0.009$) and similar during weaning (1.1 kg/d; SE = 0.04; $P = 0.9$). Postweaning, previously CF pens had greater intake than NCF when fed non-competitively ($P = 0.02$; in wk 8 and 9, 2.9 vs. 2.6 kg/d/calf, SE = 0.09, and wk 12 and 13, 4.9 vs. 4.5 kg/d/calf, SE = 0.1). During the competitive feeding period (wk 10 and 11), intake was subject to a treatment by day interaction ($P = 0.04$); previously NCF pens had initially lower intake but rapidly increased intake. Calves in previously CF pens tended to have greater ADG in noncompetitive weeks (1.4 vs. 1.2 kg/d; SE = 0.1; $P = 0.08$) and similar ADG in the competitive weeks (1.2 kg/d; SE = 0.1; $P = 0.5$). Final BW was similar between treatments (147.2 kg; SE = 4.5; $P = 0.8$). These results suggest that calves are able to adapt to moderate competition for feed in the milk-feeding stage and that prior exposure to competition influences response to feeding competition.

Key Words: dairy calf, competition, feeding

W141 Measurement of feeding motivation in limit-fed dairy heifers. A. M. Greter¹, T. F. Duffield², B. W. McBride³, T. M. Widowski³, and T. J. DeVries^{*1}, ¹*Dept. of Animal and Poultry Science, University of Guelph, Kemptville Campus, Kemptville, ON, Canada*, ²*Dept. of Population Medicine, University of Guelph, Guelph, ON, Canada*, ³*Dept. of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada*.

The objective of this experiment was to determine whether, and how hard, limit-fed heifers were motivated to work, both immediately post-feeding and following a short-term period of feed deprivation, for parcels of a low-nutritive feedstuff (i.e., oat straw) to ameliorate health concerns and meet foraging needs. Ten Holstein heifers (291.6 ± 39.2 d of age, weighing 324.2 ± 61.2 kg) were exposed to each of 2 dietary treatments, in a random order, over 2 successive 26-d treatment periods (14-d adaptation and a 12-d data collection) using a crossover design. The treatments were (1) a high-forage control TMR (60% DM; C) and (2) a limit-fed, low-forage

TMR (50% DM; LF) at 2.05% BW. During the data collection period, heifers were fed at 1100 h and then tested for feeding motivation using a push-door apparatus 3 h later (1400 h) and 21 h later (0800 h). Intakes and feeding behavior were recorded during the last 7 d of each period. Rumination was recorded during 3 d of each period. The amount of weight pushed as a % of BW and latency to access the push-door were recorded 3 times for each heifer at each time point on each treatment. Data were analyzed in a general linear mixed model. DMI was greater on the C treatment (12.9 vs. 7.2 kg/d; SE = 0.6; $P < 0.001$). Heifers on the C treatment spent more time feeding (209.3 vs. 82.4 min/d; SE = 6.2; $P < 0.001$) and ruminating (452.2 vs. 318.3 min/d; SE = 15.8; $P < 0.001$), as well as consumed their feed slower across the day (0.06 vs. 0.09 kg/min; SE = 0.004; $P = 0.001$) than heifers on the LF treatment. On the LF treatment heifers tended to pushed more weight at 3 h (4.5 vs. 1.9% of BW; SE = 1.0; $P = 0.09$) and did push more weight at 21 h (9.3 vs. 2.8% of BW; SE = 1.0; $P < 0.001$) after feed delivery. Latency to access the door was similar between treatments at 3 h (96.7 ± 45.0 s) and 21 h (113.8 ± 45.0 s) after feed delivery. In summary, heifers will work harder, spend less time feeding and ruminating, and consume feed faster when provided a low-forage, limit-fed ration compared with a high-forage, ad-libitum-fed ration, providing evidence that limit-fed animals are experiencing feelings of hunger and may not be physically or behaviorally satisfied.

Key Words: feeding behavior, limit feeding, motivation

W142 Do limit-fed heifers prefer supplementary long or short straw? A. M. Greter¹, T. F. Duffield², B. W. McBride³, T. M. Widowski³, and T. J. DeVries^{*1}, ¹*Dept. of Animal and Poultry Science, University of Guelph, Kemptville Campus, Kemptville, ON, Canada*, ²*Dept. of Population Medicine, University of Guelph, Guelph, ON, Canada*, ³*Dept. of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada*.

The objective of this study was to determine whether limit-fed heifers will choose to consume long, rather than short, particles of a low-nutritive feedstuff to ameliorate rumen function and meet foraging needs. Ten Holstein heifers (261.6 ± 39.2 d of age, weighing 303.3 ± 56.2 kg) were exposed to each of 2 dietary treatments, in a random order, over 2 successive 7-d treatment periods (4-d adaptation period and a 3-d data collection period) using a crossover design. The treatments were (1) provision of long particle oat straw (85% of particles >8 mm; LS) and (2) provision of short particle oat straw (45% of particles >8 mm; SS). Both treatments were offered following consumption of a limit-fed, nutrient-dense TMR fed at 2.05% of BW. Following these 7-d periods of exposure to each type of straw (long and short), heifers were given access to both types during an additional 2-d preference period. Individual intakes, feeding and lying behavior were recorded during the last 3 d of each treatment period. Intake and behavior data were analyzed in a general linear mixed model. Preference ratio (LS consumed/total straw intake) was tested for a difference from 0.5 using a *t*-test. Dry matter intake of both the TMR (6.3 ± 0.4 kg/d) and straw (0.36 ± 0.06 kg/d) was similar between treatments. Heifers fed LS spent more time feeding (197.7 vs. 175.2 min/d; SE = 5.7; $P = 0.01$) than heifers fed SS due to the increase in time required to consume long particles in the LS (59.8 vs. 34.2 min/d; SE = 5.0; $P = 0.007$). Daily lying time (974.7 ± 11.4 min/d) and time spent standing without eating (278.9 ± 10.4 min/d) was similar between treatments. The preference period showed a strong preference ratio for LS rather than SS (preference ratio = 0.83; SE = 0.06; $P < 0.001$), with heifers consuming 0.43 ± 0.2 kg/d of LS and 0.07 ± 0.1 kg/d of SS. In conclusion, heifers will consume similar amounts of supplementary long or short straw if provided to them alongside of a limit-fed

TMR. Limit-fed heifers do, however, show a clear preference for LS when offered the choice, suggesting that they find LS to be more satisfactory for achieving rumen fill and/or meeting their behavioral foraging needs.

Key Words: feeding behavior, limit feeding, preference

W143 The effect of calving environment on the behavior, metabolism, and milk yield of Holstein heifers. S. Y. Morrison*, P. Ji, H. M. Gauthier, S. E. Williams, and H. M. Dann, *William H. Miner Agricultural Research Institute, Chazy, NY*.

This study determined the effect of the calving environment on periparturient behavior and its potential effect on behavior, blood metabolites, and milk yield of Holstein heifers during the first 21 DIM. Heifers ($n = 54$) were housed in a bedded pack enhanced with a 4.6x4.0 m calving blind during a 21-d close-up period and then were either moved when calving was imminent to an individual pen (IND; $n = 24$) or left in the pack (GRP; $n = 30$). After calving heifers were housed in a freestall pen, fed a TMR, and milked 3x/d. Calving, standing, and rumination behaviors were monitored using visual observations, video review, and data loggers. Calving difficulty (1: easy to 5: difficult) was recorded. Serum was analyzed for nonesterified fatty acids (NEFA) and β -hydroxybutyrate (BHBA) on 0, 7, 14, and 21 DIM. Data were analyzed as a completely randomized design using the MIXED procedure of SAS with repeated measures as appropriate. Twelve GRP heifers calved in the blind and 6 IND heifers were in the blind at the time they were moved to the individual pen. IND heifers were in the individual pen for 89 ± 10 min before calving. Labor was 98 and 124 min for GRP and IND heifers (SEM = 12 min; $P = 0.11$), respectively. Calf birth weight (38.0 ± 1.1 kg) and calving difficulty score (1.7 ± 0.2) were not affected by treatment ($P > 0.10$). During the 2 h before calving, treatment did not affect standing (49 ± 5 min; 3.2 ± 1.2 bouts; 21 ± 5 min/bout) or rumination (10 ± 2 min). During the 12 h after calving, treatment did not affect standing (504 ± 14 min; 11.5 ± 0.8 bouts; $P > 0.10$), but GRP heifers tended to spend more time ruminating (78 and 60 min; SEM = 7; $P = 0.07$). During the first 21 DIM, treatment did not affect ($P > 0.10$) NEFA (0.35 ± 0.02 mEq/L), BHBA (5.9 ± 1.0 mg/dL), standing (849 ± 16 min/d; 57 ± 1 min/bout), or milk (30.7 ± 1.3 kg/d). Daily rumination was greater for GRP than IND (367 and 324 min; SEM = 15; $P = 0.03$). The calving blind was used by 40% of GRP heifers at calving and may indicate a desire for seclusion at calving. Management decisions around parturition should be considered to minimize disruptions that may delay normal calving progress and resumption of rumination after calving.

Key Words: calving, behavior, cow

W144 Rumination and feeding behavior before and after calving. K. Schirmann*, N. Chapinal, L. A. Vickers, D. M. Weary, and M. A. G. von Keyserlingk, *Animal Welfare Program, Faculty of Land and Food Systems, The University of British Columbia, Vancouver, BC, Canada*.

The objectives of the current study were to describe the changes in rumination and feeding behavior around calving. Rumination time, feeding time and dry matter intake were monitored in 11 Holstein cows from 96 h before to 48 h after calving. Data were initially summarized in 2-h periods; these data were first averaged across cows and plotted to describe the pattern relative to time of calving. Ruminating and feeding started to decline approximately 4 and 8 h (respectively) before calving and increased in the 4 and 6 h (respectively) after calving. Data were then averaged within cow to form daily values relative to calving time; the period from 96 to 24 h before calving was averaged to calculate one baseline value per cow. These data were analyzed using the mixed models in SAS with day as a repeated measure and Dunnett's 2-tailed test was used as a post-hoc test to evaluate

differences between baseline and subsequent days. Compared with baseline (baseline rumination time: 426.1 ± 26.5 min/d; baseline feeding time: 205.1 ± 13.2 min/d), cows spent 63 ± 30 min less time ruminating and 66 ± 16 min less time feeding during the day before calving. These behaviors remained lower than baseline the day after calving when, compared with baseline, cows spent 133 ± 35 min less time ruminating and 82 ± 18 min less time feeding. Cows also tended to decrease dry matter intake by 3.8 ± 1.9 kg DM the day before calving as compared with baseline (baseline: 15.7 ± 1.5 kg DM/d); dry matter intake returned to baseline values by the day after calving. In conclusion, time spent ruminating and time spent feeding show promise as tools to identify cows as they approach calving.

Key Words: welfare, parturition, dry matter intake

W146 Social constraints and motivation of dairy cows to work for access to pasture. A. C. Addressa^{1,2}, J. A. Fregonesi^{*2}, D. M. Weary¹, and M. A. G. von Keyserlingk¹, ¹University of British Columbia, Vancouver, British Columbia, Canada, ²Universidade Estadual de Londrina, Londrina, Paraná, Brazil.

In social species such as cattle, motivation to access resources may depend upon the location and behavior of social partners. This study tested how the motivation of lactating dairy cows to access to pasture, varied with the presence of familiar and unfamiliar social partners. We used a total of 24 lactating dairy cows. Twelve Holstein cows were trained to push a weighted gate to access fresh TMR, and the other 12 cows formed the unfamiliar group. The weight started at 14 kg and was increased by 7 kg/d until cows were no longer willing to perform the task. Cows were then individually allowed to push the gate to access pasture for 3 d under each of 3 conditions: (1) familiar social group on pasture, with weight set at the maximum pushed for TMR + 7 kg; (2) unfamiliar group on pasture with weight set as in treatment (1); and (3) familiar social group on pasture, with weight set at the maximum pushed for TMR + 14 kg. The number of cows pushing the gate to have access to pasture was compared using Fisher's Exact test. Cows pushed on average a maximum of 36.6 ± 9.1 kg during the TMR test and 50.4 ± 8.8 kg in treatment (3). The number of cows accessing pasture was higher in treatment 1 versus 2 (6.5 ± 0.7 versus 1.0 ± 0.0 ; $P = 0.01$), but similar for Treatment 3 (4.5 ± 2.1 ; $P = 0.12$). The results indicate that motivation to access pasture is stronger when paired with access to familiar social companions.

Key Words: social behavior, operant test, welfare

W148 Combined wavelet and linear regression techniques to model cattle behavioral responses to changes in forage allowance. M. S. Gadberry^{*1}, W. Whitworth², and G. Montgomery², ¹University of Arkansas, Cooperative Extension Service, Little Rock, ²University of Arkansas, Southeast Research and Extension Center, Monticello.

As forage availability diminishes, cattle compensate, in part, by increased grazing time. As a result, the visual cue of activity throughout the day may help delineate conditions whereby available forage negatively affects productivity. This study attempted to model dawn to dusk changes in grazing, lying, and indeterminate activity for varying amounts of available forage during summer months. Activity was visually assessed for 16 h at 1 h intervals for 3 (2010 and 2011) or 2 herds (2012) of predominately Beefmaster cows (nonlactating). To create variability in available forage without negatively influencing herd productivity, 3 (yr 1 and 2) or 2 (yr 3) pastures of different sizes were assigned to the study. Herd size was fixed at 20 cows within herd in yr 1 and 2 and 30 in yr 3. Each herd was assigned to a pasture, grazed for a 2-wk adaptation and observed during wk 3. At the conclusion of the observation wk, herds were re-assigned

pastures so all herds were grazed and observed on all pastures. Forage allowance (FA) ranged from 12.8 to 56.5 kg DM/100 kg BW. Proportional behavior responses to change in FA were transformed to Haar wavelet coefficients. ANOVA at the 2, 4, and 8 h scales indicated similar coefficient variability ($P > 0.10$) among FA allocations. Correlation between FA and individual wavelet coefficients was determined. Linear models to predict coefficients were constructed for the significant correlations that occurred for lying at level 1, position 1 and standing at level 0. The lying coefficient was predicted as $0.011944 \times \text{FA} - 0.641426$ ($r^2 = 0.47$); and the grazing coefficient was predicted as $0.009547 \times \text{FA} - 0.847766$ ($r^2 = 0.52$). Based on the predicted coefficients, from 600 to 900 h, lying activity increased as FA increased; however, from 1000 to 1300 h, lying activity decreased as FA increased then converged for 1400 to 2100 h. Prior to 1300 h, more cattle were predicted grazing as FA increased. Following 1300 h, the proportion of cattle grazing increased as FA decreased. These results indicate FA changes affect morning lying and afternoon grazing activity.

Key Words: grazing behavior, model, wavelet analysis

W149 Determinants of body temperature and feed intake in beef cattle during summer heat. A. K. Curtis*, B. Scharf, P. A. Eichen, M. S. Kerley, J. R. Russell, and D. E. Spiers, *Division of Animal Sciences, University of Missouri, Columbia.*

Heat stress in cattle has long been known to affect well-being and decrease performance. The challenge comes in determining reliable predictors of heat stress in the form of measurable, independent variables that indicate current and near-future changes in performance. A 42-d study, including 25 crossbred Angus (*Bos taurus*) steers with a body weight of 347 ± 29 SD kg, was conducted during summer 2011 to identify animal and environmental determinants of core body temperature (Tcore) and feed intake (FI). Animals were stratified by weight and housed among 5 different pens. Ambient temperature (Ta) during this period ranged from 17.3 to 40.7°C with a mean of 27.2°C. Steers were provided a feedlot diet and water ad libitum and Tcore was measured hourly using intratracheal telemetric boluses (SmartStock, Pawnee, OK). Electronic ID tags (Allflex US Inc., Dallas-Fort Worth, TX) connected to a GrowSafe FI system (GrowSafe Systems Ltd., Airdrie, AB, Canada) provided FI. Data loggers (Hobo H8 Pro; Onset Computer, Bourne MA; accuracy: $\pm 0.2^\circ\text{C}$ and $\pm 3\%$ relative humidity) recorded ambient conditions in sun and shade, along with black globe temperature (BG). Temperature-Humidity Index (THI) was calculated for all combinations. Analysis of FI used the daily sum of animal values to determine population FI, whereas Tcore used hourly daylight (0700–1900) values. Both stepwise and multivariate linear and polynomial regression analyses (JMP statistical software; SAS Institute; Cary, NC) were used for 0 to 4-d delay evaluations. Best FI predictor, based on highest R^2 was mean THI using BG in the sun, with a 3-d delay ($R^2 = 0.24$, $P < 0.005$). Analysis of Tcore used group averages for each hour. Both regression analyses identified Ta alone with no delay as the best indicator of Tcore ($R^2 = 0.62$, $P < 0.005$). These results indicate that although air temperature alone may be the best predictor of core temperature in the heat, radiant heat load may be a better determinant of feed intake over time.

Key Words: heat stress, beef cattle, telemetry

W150 Influence of pen-shade on feedlot performance of *Bos indicus* growing heifers under hot weather conditions. J. A. Vazquez¹, B. J. Cervantes², A. Camacho³, M. A. Espino³, T. J. Heras³, L. R. Flores³, J. J. Lomeli³, and R. Barajas^{*3}, ¹CUALTOS, Universidad de Guadalajara, Tepatitlan, Jalisco, Mexico, ²Ganadera Los Migueles, S.A. de C.V., Culiacan, Sinaloa, Mexico, ³Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico.

Pen-shade has shown to be beneficial to feedlot performance of cattle under hot weather conditions. Most experiments have been conducted using *Bos taurus* cattle. However, differences in heat tolerance and greater use of *Bos indicus* in hotter areas of the world suggest that we should focus on evaluating the utility of pen-shade use in these cattle as well. In this study 60 *Bos indicus* heifers (initial BW = $195.8 \pm \text{SD } 2.936$ kg) were used to evaluate the influence of pen-shade on feedlot performance of *Bos indicus* growing heifers under hot weather conditions. Heifer were weighed individually and blocked by Initial BW. Groups of 5 heifers were placed in each pen, and the pen constituted the experimental unit. In a complete randomized block design experiment, within a block, pens were randomly assigned to receive one of 2 types of allotment: (1) dirt-floor pens (6×12 m) without shade (Control); and (2) Control plus shade (Pen-shade). Shade was provided by a ceiling of 6×4 m of metal sheeting positioned 3.7 m over soil level. Cattle were weighed on d 1 and 84 when they finished the experiment. Feed intake was recorded daily. Samples of food (1 kg) were taken weekly for DM determination ($110^\circ\text{C}/24$ h). Results were analyzed by ANOVA for a randomized complete block design. The daily variation ($P < 0.01$) of temperature and relative humidity is described for its mean \pm SE observed values of $28.35 \pm 1.32^\circ\text{C}$ (maximum 40.5°C , minimum 21.1°C) and $76.0 \pm 5.98\%$, respectively. Cumulative rain was 504 mm; air velocity $7.65 \pm \text{SE } 2.59$ km/h, and sun radiation of $872 \pm \text{SE } 115$ W/m². Compared with heifers housed in the control pens, heifers housed in the pen-shade group had higher final weight (284.4 vs. $275.0 \pm \text{SE } 2.113$ kg; $P = 0.02$), superior average daily gain (1.05 vs. $0.94 \pm \text{SE } 0.026$ kg/d; $P = 0.02$), and a better feed efficiency (0.17 vs. $0.15 \pm \text{SE } 0.003$ kg of gain/kg of DMI; $P < 0.01$). Dry matter intake was not affected by treatments (6.25 vs. $6.23 \pm \text{SE } 0.070$ kg/d; $P = 0.84$). It is concluded, that provision of pen-shade contributes to improve the feedlot performance of *Bos indicus* growing heifers under hot weather conditions.

Key Words: *Bos indicus*, feedlot performance, hot weather

W151 Behavior of horses kept in large groups in a feedlot environment. J. H. Higginson Cutler*¹, M. Robertshaw¹, E. A. Pajor², L. J. Keeling³, L. Burwash⁴, C. Dewey¹, and D. B. Haley¹, ¹University of Guelph, Guelph, ON, Canada, ²University of Calgary, Calgary, AB, Canada, ³Swedish University of Agricultural Sciences, Uppsala, Sweden, ⁴Alberta Agriculture, Food and Rural Development, Airdrie, AB, Canada.

Horses kept for meat production, a legal practice in Canada, are commonly kept in large social groups; however no data about the behavior or welfare of horses in these conditions is available in the literature. The objective of this study was to describe the general activity of horses kept in large groups under dirt dry-lot conditions in western Canada. Observations were made on 18 d spread evenly over a period of time from June 1 to August 19, 2010. Scan samples were completed every 10 min to count the number of horses performing various behaviors during the following blocks of time: 0700–0900, 1000–1200, 1300–1500, and 1600–1800h. Environmental conditions at the time of observations were also recorded. Two pens of horses grouped by age were observed. The number of animals in the pens ranged from 124 to 182 in one pen and 100–200 in the second pen. The proportion of animals performing each behavior divided by the number of animals in the pen was determined for each behavior. A mean (\pm SE) of 25.2 (± 0.3)% of horses were eating, 1.1 (± 0.02)% drinking, 11.9 (± 0.4)% lying, 6.1 (± 0.1)% moving, 46.4 (± 0.6)% standing, 1.3 (± 0.06)% playing, and 4.5 (± 0.1)% grooming throughout the scan samples. Preliminary statistics examining the relationship between pen, weather (rain vs. no rain), time period, and date were analyzed using mixed models. The number of horses performing behaviors was affected by date of observation ($P < 0.05$). Rain altered the number of horses performing all behaviors ($P < 0.05$) except playing ($P = 0.35$), with lying, eating, drinking and

grooming decreasing during rain while standing increased. The number of horses performing certain behaviors was also altered by time of day, with grooming increasing throughout the day, play increasing until the final daily observation period, and lying decreasing throughout the day ($P < 0.05$). Knowledge gained regarding the behavior of horses housed in large social groups will allow for improved management practices to ensure appropriate resources are provided for these animals.

Key Words: equine, group size, behavior

W152 Barrow approachability to a novel object when selected for feed efficiency. J. Colpoys^{*1}, N. Gabler¹, A. Keating¹, S. Millman², J. Siegford³, and A. Johnson¹, ¹*Animal Science, Iowa State University, Ames*, ²*Veterinary Diagnostics and Production Animal Medicine, Iowa State University, Ames*, ³*Animal Science, Michigan State University, East Lansing*.

The objective of this study was to determine if divergent selection for residual feed intake (RFI) influenced barrows' approach to a novel object, an orange traffic cone. Twenty low-RFI (high FE) and 20 high-RFI (low FE) barrows (BW 49 ± 9.2 kg) from 8th generation Yorkshire RFI selection lines were randomly selected and evaluated once over a 4-wk period using a novel object test (NOT). The NOT arena measured 4.9 m long \times 2.4 m wide, with black corrugated plastic walls 1.2 m high. The arena floor was divided into 4 zones; zone 1 being the traffic cone while zone 4 was furthest from the traffic cone and was the point where the pig entered the arena. Between 1300 and 1700 h pigs were moved individually from their home pen and into a weigh scale for 1 min. Pigs then entered the NOT arena and were video recorded for 10 min. Video was then continuously scored by one observer for latency, duration, and total number of freezing postures (defined as whole body still for ≥ 3 s). Latency, duration, and total number of zone visits were also collected. Data were analyzed with PROC Glimmix and the experimental unit was the barrow. Latency to show the first freeze posture and total length of time freezing did not differ between selection lines ($P > 0.28$). However, low-RFI froze fewer times compared with high-RFI barrows ($P = 0.003$). Latency to enter zones: low-RFI barrows took longer entering zone 2 ($P = 0.02$), but did not differ entering zone 1 or 3 when compared with high-RFI barrows ($P > 0.17$). Duration of time within a zone: low-RFI barrows tended to spend less time in zone 3 compared with high-RFI barrows ($P = 0.09$). For all other zones there was no difference in time spent in the zones ($P > 0.36$). Number of visits: low-RFI barrows visited zones 3 and 4 less often compared with high-RFI barrows ($P < 0.02$). For all other zones there was no difference in number of visits ($P > 0.24$). These data suggest that differences exist in the response to a novel stressful situation between barrows of different RFI lines. Therefore, the ability of livestock to recognize and cope with stress may be related to RFI and feed efficiency.

Key Words: novel approach, residual feed intake, pig

W153 Influence of dietary flavors on sheep feeding behavior and nutrient digestibility. J. J. Villalba^{*1}, A. Mereu², and I. R. Ipharraguerre², ¹*Utah State University, Logan*, ²*Lucta, S.A., Montornés del Vallés, Spain*.

A variety of flavored feeds may enhance intake relative to a monotonous diet. The aim of this study was to assess whether the feeding pattern displayed by sheep exposed to a monotonous ration is modified when the same ration is presented in a diversity of flavors and if such diversity influences nutrient digestibility. Twelve wethers (3 lambs/group/period) were housed in metabolic crates during 2 successive periods. One group of lambs [Diversity (D)] was fed simultaneously an unflavored TMR of alfalfa, barley, beet pulp, and urea (55:35:9:1) and the same ration supplemented (0.2%) with

one of 2 flavors: 1) sweet, and 2) umami. The other group [Monotony (M)] received just the unflavored TMR. All animals were fed their respective rations ad libitum from 0800 to 1600. The first 20 d of each period were used for adaptation, and the last 6 d were used for sample collection. On d 20, intake was assessed every 30 min for 8 h (feeding pattern). Intake was estimated by subtracting the amounts of feed offered and refused. Intake values were matched with composited samples of feces to determine digestibility. The design of the experiment was a split-plot design with lambs nested within groups and period, day and time interval (feeding pattern) as repeated measures. On average, lambs in D tended to consume more feed than lambs in M ($P = 0.08$). Lambs in D showed greater intakes than M during 30 ($P = 0.006$), 60 ($P = 0.02$), 90 ($P = 0.02$), 120 ($P = 0.04$), and 180 min ($P = 0.07$) after offering the rations. Digestibility of CP ($P = 0.08$) tended to be lower for lambs in D than for lambs in M. Lambs in M and D digested the same amount of DM, NDF, ADF, and N ($P > 0.10$). Flavor diversity did not affect N retained, N retained/N consumed, or ruminal pH 1 h after feeding ($P > 0.10$). In conclusion, exposure to diverse flavors in the same ration has the potential to increase feed intake relative to monotonous rations due to changes in feeding patterns occurring within the first 180 min of feeding. This enhanced consumption likely contributed to the slight decline observed for DM and CP digestibility. The amount of nutrients digested, however, was not influenced by such a decline.

Key Words: flavor, behavior, intake

W154 Metabolic profile of sheep and their lambs in an artificial nursing system. L. H. Díaz-García^{*}, L. P. López-Huitraco, A. Muro-Reyes, H. Gutiérrez-Bañuelos, and J. A. López-Román, *Universidad Autónoma de Zacatecas, Zacatecas, México*.

The artificial nursing system is a methodology that must be used in most sheep farms as it can help reduce the high mortality rates of lambs in the first days of life. The aim of this study was to evaluate seric blood concentrations of glucose (GL), triglycerides (TG; mg/dL) and total protein (TP) (gr/dL) in ewes (SH) and their lambs (LB) during artificial (AN) and natural nursing (NN). Samples were obtained by jugular venipuncture at 1, 8, 15 and 22 d (experimental period) after birth, and chemical profile obtained by spectrophotometry. We used 20 third-parity SH (10 per treatment) and their respective LB, divided into 2 treatments (Tx): artificial nursing (AN, n = 13; lambs did not nurse their dams) and natural nursing (NN, n = 12; lambs nursed their dams). Data were analyzed with PROCGLM, running an ANOVA to detect differences between Tx and animal type. Also, Pearson correlation coefficients (PROC CORR) were run to assess relations between variables. All data was computed by SAS statistical package. Data are shown on Table 1. No differences were found ($P > 0.05$) between Tx for SH in any of the variables evaluated. For LB, both GL and TG differs ($P < 0.001$ and < 0.05 , respectively). It was concluded that the type of nursing does not influence the chemical blood parameters of sheep, and nonetheless GL and TG differs on lambs, both chemical variables are within normal ranges.

Table 1. Means (\pm SD) for each metabolite by treatment (artificial nursing, AN, and natural nursing, NN) and animal type (ewe, lamb)

Variable	Ewe		Lamb	
	AN	NN	AN	NN
Glucose	40.44 \pm 17.79	40.66 \pm 23.6	52.27 \pm 26.8 ^b	84.77 \pm 29.28 ^a
Triglycerides	26.13 \pm 15.67	27.07 \pm 13.2	68.01 \pm 35.72 ^b	89.16 \pm 30.93 ^a
Total protein	7.3 \pm 1.39	6.82 \pm 1.6	4.45 \pm 1.62	5.05 \pm 1.47

^{abc}Different superscripts represent significant difference ($P < 0.05$) between treatments.

Key Words: sheep, lamb, artificial nursing

W155 Individual behavior of lambs confined in enriched environment. J. P. A. Lorenço¹, P. A. Bustos Mac-Lean*¹, N. Mora¹, J. M. Malheiros², T. Zunino¹, C. G. Titto³, B. S. Lala¹, and F. A. F. Macedo¹, ¹State University of Maringá, Maringá, PR, Brazil, ²Faculty of Agriculture and Veterinary Sciences, Jaboticabal, SP, Brazil, ³University of São Paulo, FZEA/USP, Pirassununga, SP, Brazil.

This research aimed to investigate the influence of environmental enrichment with brushes on individual behavior of confined lambs. The project was lead at Maringá-PR, October to December 2012. Were used 6 Pantaneira lambs allotted in individual pens. The behavior was measure by the focal method on 6 separate days, 5 h in afternoon each day (which heat stress increases due to combination of high temperature air and relative humidity in tropical climates). The behavioral assessment divided the 2 treatments, and the first 3 observations without the object and the other 3 observations, put up a brush located in the region above the feeder. The activity patterns of the animals were recorded in an ethogram field every 5 min, and were noted the times of posture (standing or lying) and activities (eating, drinking, ruminating, idleness, brushing and other activities). Behavior data were analyzed by Student's *t*-test to compare means before and after introduction of environmental enrichment using SAS-STAT at a significance level of 0.05. The air temperature and relative humidity within the stall had a variation 25.7 to 35.2°C and 47 to 81%, respectively, causing heat stress to the animals. Table 1 shows that the frequency of the lying position and ruminating activity was significantly higher in the evaluation of lambs when there was enrichment in the pens and this behavior shows that the animals are under a high level of welfare. When lambs remain standing for long, they may be trying to lose heat to the environment. Thus, environmental enrichment alters the behavior of lambs in the hottest hours of the day and can be a tool to reduce stress in confined animals.

Table 1. Frequency of behaviors (means ± SE; %/5 h) observed in lambs with and without environmental enrichment

Behavior	Without brush	With brush
Posture		
Standing	41.4 ± 0.1 ^a	32.2 ± 0.1 ^b
Lying	58.6 ± 0.1 ^b	67.8 ± 0.1 ^a
Activity		
Eating	20.0 ± 0.1 ^a	10.4 ± 0.1 ^b
Drinking	2.3 ± 0.04 ^b	3.8 ± 0.06 ^a
Ruminating	11.8 ± 0.1 ^b	18.4 ± 0.1 ^a
Idleness	43.3 ± 0.1 ^a	39.4 ± 0.1 ^b
Brushing	0.0 ± 0.0 ^b	11.8 ± 0.1 ^a
Other	22.6 ± 0.1 ^a	16.1 ± 0.1 ^b

^{a,b}Means followed by different small letters in column differ by *t*-test ($P < 0.05$).

Key Words: environmental enrichment, welfare, lambs

W156 Creation and persistence of conditioned aversion to grape leaves and sprouts for grazing sheep in vineyards. C. L. Manuelian¹, E. Albanell¹, M. Rovai¹, A. A. K. Salama^{1,2}, and G. Caja*¹, ¹Group of Ruminant Research (G2R), Universitat Autònoma de Barcelona, Bellaterra, Spain, ²Animal Production Research Institute, Dokki, Giza, Egypt.

Sheep grazing is a sustainable and environmentally friendly alternative to the traditional vineyard weed control without using machinery and herbi-

cides. However, vineyard grazing has its drawbacks; sheep are attracted by grape leaves and sprouts. Sheep grazing in vineyards usually damages vines, compromising grape quantity and quality. With this in mind, 2 mid-term and consecutive experiments were conducted with 12 Manchega and 12 Lacaune ewes, consisting of Exp. 1: Aversion induction to grape leaves (novel food) and persistence evaluation under simulated grazing conditions; and Exp. 2: Descriptive study in a commercial vineyard. In Exp. 1, ewes were allocated into 4 groups (6 ewes/group and breed) in which grape leaves intake was measured after dosing lithium chloride (AV, 225 mg LiCl/kg BW) or water (C, control). Induced aversion was created after offering individually 100 g of grape leaves (var. Tempranillo) in pens for 30 min, and orally administering a single LiCl dose post-consumption; validation was done individually for 3 d. Aversion persistence on a simulated vineyard (2 kg leaves and sprouts var. Tempranillo in wood frames on a ryegrass prairie) was tested during 30 min in 11 sessions (d 5 to 375). Intake data was analyzed by a nonparametric Mann-Whitney U-test using SPSS v.19.0.0 of IBM. On average, C ewes avidly ate grape leaves whereas AV ewes fully refused them, either during validation in the pens (95.1 ± 1.9 vs. 0 g/d and ewe; $P < 0.001$) or in the simulated vineyard (1.47 ± 0.06 vs. 0 kg/group; $P < 0.001$). In Exp. 2, AV ewes were moved to a commercial vineyard (var. Merlot; Penedes county, Barcelona, Spain) and allowed to rotationally graze for 3 h/d during 10 d (d 401 to 410). Averted ewes reduced grass cover between vine lines by 70% but they started to bite grape leaves and sprouts when grass was scarce (d 403 to 410); no significant damage in the vines was visually appreciated. In conclusion, aversion to grape leaves and sprouts persisted in the AV ewes for 1 yr but, in practice, the use of a reinforcing LiCl dose after this time is recommended for assuring an effective aversion behavior in grazing sheep.

Key Words: aversion, grazing, sheep

W157 Feed management of psittacines in captivity using energy requirement equations. V. M. Pereira, T. S. G. Carvalho, V. D. L. Assis, F. M. O. B. Saad, and C. E. P. Saad*, Federal University of Lavras, Lavras, Minas Gerais, Brazil.

Captive birds have decreased energy requirement as a result of reduction in living space. Furthermore, ad libitum feeding can induce overweight and may favor the selection for fruits and the rejection of extruded feedstuffs. The selection of feeds by parrots can cause an imbalance of the diet and induce nutritional disorders. Selection also increases feed wastage, mainly of extruded feeds. Two Red Macaws (*Ara chloroptera*), three Blue Macaws (*Anodorhynchus hyacinthinus*), and three Purple Breast Parrots (*Amazona vinacea*) from the "Fundação Zoobotânica" Zoo, Belo Horizonte, Brazil, were used. Before the experiment birds were fed ad libitum. During the trial, birds were fed according to their energy requirement, calculated as body weight to the 0.75 power multiplied by (156 kcal/kg BW^{0.75}) for 28 days. The diet contained 70% of extruded dry feed (corn, wheat germ, soybean meal, egg powder, wheat bran, beet pulp, minerals and vitamins) and 30% of fruits (papaya, banana, orange, and apple). The birds were weighed initially and weekly until the end of the experiment and the initial and final weight compared by Student's *t*-test. Even with restricted feeding, the bird's weight showed no statistical differences ($P > 0.05$) between the initial and final weight. It can be concluded that using formulas based on energy requirements for maintenance do not affect the bird's body weight and contribute to avoid waste of food. Acknowledgment: Fundação Zoobotânica of Belo Horizonte city, CAPES and FAPEMIG.

Key Words: parrot, energy, controlled feeding