

Ruminant Nutrition: Beef I

M247 Carcass primary cuts proportions of Nellore bulls stratified for residual feed intake. F. L. Araujo*¹, R. H. Branco², C. D. A. Batalha¹, S. F. M. Bonilha², A. C. Queiroz¹, and W. P. Costa¹, ¹*Departamento de Zootecnia, Universidade Federal de Viçosa, Viçosa, MG, Brazil,* ²*Centro APTA Bovinos de Corte, Instituto de Zootecnia, Sertãozinho, SP, Brazil.*

The study was conducted to evaluate proportion of primary cuts in carcass of Nellore bulls stratified for residual feed intake (RFI). Thirty animals with 414 ± 35.68 kg BW and 18 ± 1.11 mo of age, were evaluated in 2 experiments. The bulls were stratified in low RFI ($< \text{mean} - 0.5 \text{ SD}$; $n = 14$) and high RFI ($> \text{mean} + 0.5 \text{ SD}$, $n = 16$), and 2 feeding levels: ad libitum and restricted (65 g DM / kg BW^{0.75}). After slaughter and carcasses chilling period (24h), the right half-carcasses were divided in hindquarter, forequarter and spare ribs, which were weighed and had their ratio calculated based on cold half-carcass weight. Edible primary cuts were determined based on the relationship between the sum of cuts weights and the respective carcass primary cut weight; bones proportion was determined based on the relationship between the sum of bones weight and the respective primary cuts weight; shavings proportion was determined based on the relationship between the sum of shavings weight and the respective primary cut weight. Statistical analyzes were performed according to a 2x2x2 factorial scheme (2 RFI groups, 2 feeding levels and 2 experiments) in a completely randomized design, assuming $\alpha = 0.05$. There were no effect of different RFI levels in hindquarter weight (60.93 kg and 63.33 kg, respectively for low and high RFI; $P = 0.2549$), forequarter weight (51.39 kg and 54.82 kg, respectively for low and high RFI; $P = 0.1123$), spare ribs weight (17.95 kg and 19.01 kg, respectively low and high RFI; $P = 0.2112$), hindquarter edible portion (71.44% and 71.02%, respectively for low and high RFI; $P = 0.4621$), forequarter edible portion (64.25% and 65.60%, respectively for low and high RFI; $P = 0.1473$), spare ribs edible portion (43.26% and 45.27%, respectively for low and high RFI; $P = 0.3233$), hindquarter bones proportion (20.73% and 20.78%, respectively for low and high RFI; $P = 0.9167$), forequarter bones proportion (22.33% and 21.77%, respectively for low and high RFI; $P = 0.4982$), spare ribs bones proportion (14.37% and 14.91%, respectively for low and high RFI; $P = 0.4240$), hindquarter shavings proportion (10.14% and 10.64%, respectively for low and high RFI; $P = 0.3221$), forequarter shavings proportion (13.19% and 12.58%, respectively for low and high RFI; $P = 0.5399$) and spare ribs shavings proportion (16.64% and 16.21%, respectively for low and high RFI; $P = 0.7414$), showing that more efficient bulls (low RFI) had a lower dry matter intake ($P = 0.0003$) and had similar carcass traits ($P > 0.05$) when compared with less efficient animals (high RFI). RFI can be used to increase efficiency and reduce costs of production systems without resulting in damage to the carcasses of Nellore bulls.

Key Words: edible portion, Nellore, RFI

M248 Creatinine excretion and metabolizable protein requirements for maintenance of Red Norte young bulls. T. R. Amorim, M. M. Ladeira,* M. L. Chizzotti, J. R. R. Carvalho, A. R. V. Lima, N. L. Magalhães, and P. D. Teixeira, *Federal University of Lavras, Lavras, MG, Brazil.*

Protein is an expensive nutrient in beef cattle diets, and its correct balance is important to achieve high performance of the animals. In addition, an excess of dietary protein can increase nitrous oxide emissions. Therefore, the objective of this trial was to investigate the creatinine excretion and metabolizable protein requirements for maintenance of Red Norte young

bulls. The experiment was conducted in a completely randomized design, with 5 treatments and 7 repetitions. Thirty-five animals, with an average live weight of 280 ± 4 kg, were allocated to individual pens, and received the following CP levels in the diets: 8, 10, 12, 14 and 16%. After 9 d for diet adaptation, total urine and feces collections were performed for 5 d. Metabolic fecal nitrogen, urinary endogenous losses and total endogenous losses were all estimated by regression approach. Creatinine concentration in urine was analyzed using colorimetric method. Protein levels did not influence ($P > 0.05$) creatinine excretion. The net protein requirements for maintenance were obtained as the intercept of the regression of retained nitrogen on nitrogen intake ($0.441 \times 6.25 = 2.75$ g/EBW^{0.75}; $P = 0.006$), with a partial efficiency of use of metabolizable protein to net protein for maintenance of 0.68 ($P < 0.001$). This efficiency is very similar of the values reported by NRC (1985) and BR-Corte (2010): 0.67, and 0.667, respectively. Using this efficiency and assuming the net protein requirement of 2.75 g of net protein/EBW^{0.75} for maintenance, the daily metabolizable protein requirement was calculated as 4.05 g/EBW^{0.75}. According to this result, protein requirements for maintenance of Red Norte young bulls was higher than the value described by the NRC (1996) (3.8 g/EBW^{0.75}), and very close to the requirement recommended by BR-Corte (2010) (4.03 g/EBW^{0.75}).

Key Words: crude protein, nitrogen, requirement systems

M249 Measurement of purine derivatives and creatinine excretion in steers fed fescue seed. J. H. Eisemann,* G. B. Huntington, and A. E. Lamb, *North Carolina State University, Raleigh.*

The objectives were to measure urinary excretion of purine derivatives (PD) and creatinine (CRT) in steers in response to dietary ergot alkaloids, and to compare total daily and spot collections. Angus steers ($n = 8$) were fed a concentrate mix: switchgrass hay (40:60) diet containing endophyte-free (E-) or endophyte-infected (E+; 2.7 mg/d total ergot alkaloids, 9.6 ug/kg BW) fescue seed. Steers were housed indoors in individual pens with daily temperature ranging from 23.5 to 32.1°C. The design was a single reversal with 14-d treatment periods and 21 d between periods. Steers were fitted with a harness for total collection of urine on d 12 and 13 of each period. Urine was collected at 6-h intervals beginning at 1200 h on d 13. Aliquots from each interval collection within days were combined to form a daily collection. A spot urine sample was collected at 0800 and 1400 h. Urine PD and CRT were analyzed by HPLC. Data ANOVA included effects of treatment, day, and period. Steers' BW and DMI did not differ ($P = 0.20$) for E- (290 kg, 5.49 kg/d) and E+ (289 kg, 5.38kg/d). In total daily collections, urinary CRT excretion was lesser ($P < 0.05$) for E- than E+. Means were 1.13 and 1.21 mmol CRT per kg BW^{0.75}, respectively. The PDC ratio (PD/CRT, 1.21 and 1.08) and PDC index (PDC ratio x BW^{0.75}, 85.0 and 75.0) were greater ($P < 0.01$) for E- than E+. Total PD excretion (mmol/d) did not differ ($P < 0.15$) for E- (95.8) and E+ (91.0). Estimated microbial N production was not affected by E+ and was 58.8 and 54.8 g N/d for E- and E+, respectively. In spot collections, PDC (1.21 and 1.10) and PDC index (84.9 and 76.5) were greater ($P < 0.01$) for E- than E+. Calculated PD excretion (mmol/d) from spot collections was greater ($P < 0.01$) for E- (99.3) than E+ (89.5). Treatment responses were similar for PDC and PDC index in total daily and spot collections; however, treatment responses differed for total daily PD excretion and calculated daily PD excretion from spot samples. Treatment responses indicate urinary CRT excretion per kg BW^{0.75} is not a constant for calculating PD excretion and microbial N production.

Key Words: purine derivatives, creatinine, steers

M250 Feedlot performance and carcass characteristics of limit-fed steers. K. Thompson^{*1}, P. Gunn², R. Lemenager², M. Claeys², T. Nennich², and S. Lake¹, ¹University of Wyoming, Laramie, ²Purdue University, West Lafayette, IN.

The objectives of this study were to evaluate limit-fed feedlot steers on performance and carcass characteristics. Angus crossed steers (n = 168) were randomly blocked into one of 24 pens (6 pens/treatment; 7 steers/pen) and assigned to one of 4 dietary treatments: 1) 85% ad libitum intake 2) 90% ad libitum intake 3) 95% ad libitum intake; or 4) 100% ad libitum intake. Diets consisted of a corn-based finishing ration and the percentage of intake was calculated from the 100% ad libitum treatment on a weekly basis. All animals were harvested when their respective 12th rib fat depth reached 0.4 tenths. Data were analyzed using the MIXED procedure of SAS with preplanned orthogonal contrasts between the 4 dietary treatments. As expected, steers on the 100% ad libitum diet had greater DMI ($P < 0.001$) compared with all other treatments. Steers on the 95% ad libitum diet had greater DMI ($P < 0.001$) compared with the 85 and 90% ad lib diets, however, there was no difference ($P = 0.26$) between the 85 and 90% ad libitum treatments. Total ADG over the course of the study was greater ($P = 0.002$) for steers on the 100% ad libitum treatment; however, there were no differences ($P \leq 0.36$) between the other treatments. Steers on the 90% ad lib diets had a greater G:F ($P = 0.01$) compared with steers on the 95% ad lib treatment, while the 85 and 100% ad lib treatments were intermediate. Days on feed were greater ($P = 0.003$) for steers on the 85 ad libitum treatment when compared with the 95 and 100% ad libitum intake treatment; however, there was no difference ($P = 0.29$) between the 95 and 100% ad libitum treatments. Total feed costs did not differ ($P = 0.47$) between treatments. Steers on the 85% ad lib treatment group had less ($P = 0.01$) KPH fat compared with all other treatments; however, no differences ($P \geq 0.17$) were detected in HCW, 12th rib fat, REA, yield grade, or quality grade. Limit-feeding steers decreased DMI without sacrificing carcass quality; however, because days on feed were increased, there appears to be no economic advantage to limit-feeding feedlot steers.

Key Words: limit-fed, feedlot, steers

M251 Ergovaline disappearance from a ruminally incubated buffer. A. P. Foote^{*1}, N. B. Kristensen², J. L. Klotz³, K. R. Brown³, J. R. Strickland³, D. H. Kim¹, A. F. Koontz¹, K. R. McLeod¹, L. P. Bush¹, and D. L. Harmon¹, ¹University of Kentucky, Lexington, ²Syddansk Kvæg, Vojens, Denmark, ³USDA-ARS, FAPRU, Lexington, KY.

Ergovaline (ERV) is an alkaloid present in endophyte-infected tall fescue (*Lolium arundinaceum*) that contributes to fescue toxicosis in cattle. To determine disappearance of ERV in the washed reticulorumen, steers (n = 8) were pair-fed alfalfa cubes at $1.5 \times NE_m$ and dosed with ground endophyte-infected tall fescue seed (E+) or endophyte-free tall fescue seed (E-) via rumen cannula $2 \times$ daily for 7 d at thermoneutral (TN; 21°C) and heat stress (HS; 32°C) conditions. On d 8, the rumen was emptied and rinsed. Buffer containing VFA was incubated with 0.015 mg ERV/kg BW ($1 \times$ EXT) followed by an incubation with 0.045 mg ERV/kg BW ($3 \times$ EXT). The ERV in the buffer was supplied as a seed extract. For each buffer treatment there were 2 consecutive 30-min incubations where the first 30 min buffer incubation was not sampled. Following removal of the buffer an identical sampling buffer was incubated with the addition of Cr-EDTA. Buffer was sampled at 5, 15, and 30 min. Analysis of buffer samples for ERV was conducted using an Acquity UPLC with a TQ detector. Disappearance of ERV was calculated by changes in the pool size in the buffer corrected for dilution by physiological water and passage out of the rumen. In this model, ERV disappearance is the sum of absorption into blood, adsorption to the rumen wall or residual

digesta particles, and metabolism. Treatment of steers with E+ seed had no effect on ERV disappearance ($P = 0.64$). ERV disappearance rate was higher with the $3 \times$ EXT than $1 \times$ EXT ($P = 0.02$). The interaction of temperature and buffer ($P = 0.08$) indicated that ERV disappearance increased 6.5-fold with increasing ERV during HS, but only increased 2-fold during TN. These data indicates that increasing the ruminal ERV dose increases ERV disappearance in steers at high ambient temperatures which could be caused by increased absorption rate, metabolism, or binding of ERV.

Key Words: washed reticulorumen, fescue toxicosis

M252 Body condition score and heart girth change between 7 and 18 months of age to estimate pregnancy probability of Hereford heifers mated at 18 months of age. J. B. G. Costa Junior^{*1}, J. O. J. Barcellos¹, J. C. Whittier², I. D. P. S. Diaz³, L. Canellas¹, V. Peripolli¹, J. K. Ahola², and R. K. Peel², ¹Universidade Federal do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil, ²Colorado State University, Fort Collins, ³Universidade Estadual Paulista, Jaboticabal, Sao Paulo, Brazil.

Our objective was to use body condition score (BCS) and heart girth (HG) to estimate pregnancy probability (OR, odds ratio) in Hereford heifers at 18 mo of age originated from a commercial cattle herd at a facility in the state of Rio Grande do Sul, Brazil. Heifers were developed at 3 different levels of average daily gain - (ADG) (high - H, moderate - M and low - L) with 3 different combinations (LHM; HLL; MMH). These ADG levels were applied between 7 to 12 mo (P12); 12 to 15 mo (P15) and 15 to 18 mo of age (P18). Used to the LHM, MMH, and HLL treatments 65, 58, and 60 heifers respectively. This was done by OR, being adjusted within a complete model involving the treatment classifying variables and all the continuous variables (body weight - BW, hip's height - HH, heart girth - HG, body weight:height ratio - WH) at the age of 7, 12, 15, and 18 mo. The variables selected for this study were the BCS at 12 mo (BCS12) and HG at 18 mo (HG18), within the effect of treatment ($y = -30.6165 + 1.5294 \text{ BCS12} + 0.1701 \text{ HG11} + \text{Treat} (\text{HLL} = 0.0; \text{LHM} = 1.1699 \text{ and } \text{MMH} = 2.2996); \text{H\&L} = 0.30$). The HLL treatment was taken as reference once it was determined to result in the lowest percentage of pregnancy. The heifers receiving the LHM treatment had 3.2 times more chances to conceive, while heifers in the MMH treatment presented a ratio 9.9 times higher than the ones of the HLL treatment. The variable HG18 effect showed higher significance ($P < 0.05$) in the pregnancy probability model than the BCS12. We conclude that high HG18, even when combined with low BCS12, produces high pregnancy probability estimates, however, the opposite does not happen. The measure of heart girth at the beginning of the mating is a good reference for the estimation of the pregnancy rate.

Key Words: average daily gain, body weight, logistic model

M253 Use of body weight gain at different ages to evaluate the pregnancy probability and the change in the pregnancy chance of Hereford heifers mated at 18 months of age. J. B. G. Costa Junior^{*1}, J. O. J. Barcellos¹, J. C. Whittier², I. D. P. S. Diaz³, L. Canellas¹, V. Peripolli¹, J. K. Ahola², and R. K. Peel², ¹Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil, ²Colorado State University, Fort Collins, ³Universidade Estadual Paulista, Jaboticabal, Sao Paulo, Brazil.

The objective of this study was to evaluate the estimated pregnancy probability and the change in the pregnancy chance (odds, ratio - OR) using variable body weight (BW) in Hereford heifers at 18 mo of age originated from a commercial cattle herd at a facility in the state of Rio Grande do

Sul, Brazil. Three different levels of average daily gain - ADG (high - H, moderate - M and low - L) with 3 different combinations (LHM; HLL; MMH) were considered. These ADG levels were applied between 7 to 12 mo (P12); 12 to 15 mo (P15) and 15 to 18 mo of age (P18). Used to the LHM, MMH, and HLL treatments 65, 58, and 60 heifers respectively. To determine these effect OR was adjusted within a complete model involving the treatment classification variables and all the continuous variables of body weight (BW), hip height (HH), heart girth (HG), body weight:height ratio (WH) at the age of 7, 12, 15, and 18 mo. This study used only the variable BW gain from 7 to 12 mo of age (BWG12), from 12 to 15 (BWG15), and from 15 to 18 mo of age (BWG18), 30 d before and during the mating time. The last 2 variables (30 d before and during the mating time) did not enter into the model and therefore were excluded from further consideration ($P > 0.3$) ($y = -3.6131 + 0.0431 \text{ BWG12} + 0.0432 \text{ BWG15} + 0.0302 \text{ BWG18}$; $H\&L = 0.77$). There was a similar change in the OR as to an increase of 10 kg of BW in the P12 and P15 periods. However, at the age of 18 mo, showed a 54% increase in the changing rate. During P18, before the mating time, an increase of 35% in the pregnancy chance for every 10 kg of BW gained was observed. According to the average BW in each treatment at the end of each period, an increase of 10 kg represents 5% of the BW at the age of 12 mo, 3.7% of the BW at the age of 15 mo, and 3.2% of the BW at the age of 18 mo. We conclude that using the pregnancy probability described in this study will provide a useful tool for decisions related to heifer development for heifers mated at 18 mo of age.

Key Words: average daily gain, logistic model, mating time

M254 Use of a fescue seed model to study effects of ergot alkaloids on temperature regulation in steers. G. B. Huntington* and J. H. Eisemann, *North Carolina State University, Raleigh.*

The objective was to measure changes in surface temperature (ST) of the left ribs, rectal temperature (RT), blood pressure (BP), heart rate (HR), and respiration rate (RR) in steers fed diets containing either endophyte-free (E-) or toxic endophyte-infected (E+) fescue seed under conditions where the temperature was above the thermoneutral zone. Angus steers ($n = 8$) were housed indoors in individual pens and adapted to a concentrate mix:switchgrass hay (40:60) diet. Seed replaced soy hulls in the basal diet for E- and E+ (2.7 mg/d total ergot alkaloids; 9.6 ug/kg BW). Design was a single reversal with 14-d periods and 21 d between periods. Baseline measurements were taken 2 d before the start of each period. Measurements were taken at 0730, 1230, and 1530 h on d 4, 8, and 14 of each period. Digital infrared thermographic imaging was used to measure ST. Data analysis included effects of treatment, day, and period with baseline data used as covariates. Mean (SD) daily temperature ranged from 23.5°C (1.3) to 32.1°C (1.6). Steers' BW and DMI did not differ ($P = 0.20$) for E- and E+ and were 285 and 288 kg (SE 4.3) and 5.49 and 5.38 kg/d (SE 0.09), respectively. Steers' RT, ST, and RR were greater ($P < 0.05$) with E+ and increased ($P < 0.01$) with time of day. Means for RT (°C) for E- and E+ at 0730, 1230, and 1530 h were 38.1, 38.3, and 38.5; and 38.2, 38.6, and 38.9, respectively. Steers' ST (°C) for E- and E+ at 0730, 1230, and 1530 h was 36.6, 37.9, and 38.4; and 37.1, 38.2, and 38.9, respectively. Steers' RR (breaths/min) for E- and E+ at 0730, 1230, and 1530 h was 27, 33, and 35; and 29, 41, and 44, respectively. Steers' HR decreased ($P < 0.01$) when fed E+ but increased ($P < 0.01$) with time of day. Systolic BP did not respond to E+ but diastolic BP increased ($P < 0.05$) with E+. Means for HR (beats/min) were 62 and 57, and for diastolic BP (mm Hg) were 48 and 51 for E- and E+, respectively. Greater surface temperature in response to E+ was not sufficient to prevent increased rectal temperature. Decreased heart rate in response to E+ may explain the impairment of thermoregulation.

Key Words: steers, tall fescue, thermoregulation

M255 Deposition of muscular and subcutaneous fat tissues of Nellore steers fed pasture with crude glycerin. E. San Vito,* T. T. Berchielli, J. F. Lage, E. E. Dallantonia, L. M. Delevatti, C. S. R. Junior, R. G. Canesin, M. Machado, A. F. Ribeiro, R. A. Silva, and R. A. Reis, *Universidade Estadual Paulista "Júlio de Mesquita Filho," Jaboticabal, São Paulo, Brazil.*

The aim of this work was to evaluate the deposition of muscular and subcutaneous fat tissues of steers fed crude glycerin (CG) on pasture. The rib eye area (REA), the rib fat thickness between the 12th and 13th ribs (RFT) and the subcutaneous fat thickness in the region P8 (P8) of growing Nellore steers under grazing in the dry season were evaluated, supplemented with different levels of crude glycerin. The CG used was derived from soybean biodiesel production (80% glycerol). Fifty Nellore steers with initial shrunk body weight of 279.52 ± 16.31 kg were used, distributed in 5 treatments in a completely randomized design. The animals were distributed in 10 paddocks, with 1.8 ha each (2 paddocks per treatment), of *Brachiaria brizantha* 'Xaraés'. Treatments were constituted by 5 levels of CG inclusion in the supplement: (0, 7, 14, 21 and 28% of CG based on dry matter) as a substitute to the corn grain. The animals were supplemented daily in a proportion of 0.7% of body weight, and it contained 40% of crude protein based on dry matter. The supplement was constituted of corn grain, soybean meal, urea, gluten meal and mineralized salt. The experiment was executed in 136 d. The measurements were done in the beginning of the experiment and in each 28 d, through the use of ultrasound, to evaluate the deposition of muscular and subcutaneous fat tissues. Data was analyzed using the MIXED procedure of SAS program. There was no statistical significance ($P > 0.05$) among the treatments, and the final observed average values were: 61.5 cm² to REA, 2.4 mm to P8 and 2.0 mm to RFT. The gain observed in the variables (initial value - final value) AOL, P8 and SFT were of 18.2 cm², 0.57 mm and 0.47 mm, respectively. Crude glycerin can be a substitute to corn grain up to 28% in supplements to growing Nellore steers on pasture, without affecting animals' muscular and subcutaneous fat tissues growth.

Key Words: growth, forage, ultrasound

M256 Differences in residual feed intake are largely associated with changes in body weight gain composition. M. L. Nascimento*¹, A. R. D. L. Souza¹, R. R. Tullio², M. M. Alencar², A. N. Rosa³, and D. P. D. Lanna¹, ¹University of Sao Paulo, Piracicaba, São Paulo, Brazil, ²Embrapa Cattle Southeast, São Carlos, São Paulo, Brazil, ³Embrapa Beef Cattle, Campo Grande, Mato Grosso do Sul, Brazil.

Residual feed intake (RFI) is defined as the difference between observed and predicted intake (predicted from the average weight and daily gain). RFI has been proposed as an index for genetic selection, however differences in body composition were pointed as a limiting factor in genetic selection based on RFI. The objective of this work was to study the relationship between RFI and gain composition in Nellore steers. Two hundred and 81 Nellore steers, progeny of 30 2 bulls, were individually fed for a minimum period of 70 d. The diet contained 2.8 Mcal ME/kg DM and 13.5% crude protein and was supplied twice a day for ad libitum intake. The animals were classified in low, medium and high RFI (mean \pm 0.5SD) and then extreme classes were compared. Results are presented on the table below. The high RFI animals retained 0.7 Mcal/day more energy than the low RFI animals ($P < 0.05$). Therefore the change in estimated body weight composition explained 37.4% of the 1.54 kg/d difference in feed intake between high and low RFI classes. This effect is far greater than the 5% suggested in the literature by different authors based on regression analysis.

Table 1.

| | Low RFI | High RFI | Mean ± SD |
|--|-------------------|--------------------|--------------|
| RFI, kg/d | 0.79 ^a | -0.78 ^b | -0.06 ± 0.04 |
| Gain, kg/d | 1.35 | 1.37 | 1.33 ± 0.02 |
| DMI, kg/d | 9.16 ^a | 7.64 ^b | 8.22 ± 0.07 |
| Initial ribeye, ¹ cm ² | 45.2 | 45.7 | 44.6 ± 0.4 |
| Final ribeye, ¹ cm ² | 56.4 | 56.6 | 56.9 ± 0.4 |
| Initial fat thickness, ¹ mm | 2.71 | 2.71 | 2.64 ± 0.07 |
| Final fat thickness, ¹ mm | 5.63 ^a | 5.05 ^b | 5.00 ± 0.10 |
| Retained energy, ² Mcal/d | 4.36 ^a | 3.66 ^b | 3.98 ± 0.08 |
| % fat ³ | 28.3 ^a | 22.1 ^b | 25.9 ± 0.8 |
| % Intramuscular fat | 2.70 ^a | 2.30 ^b | 2.62 ± 0.06 |

^{ab} $P < 0.05$ (CONTRAST/SAS).

¹Ultrasound.

²EBWEnergy = $-126.7 + 10.9 * \text{ribeye} + 70 * \text{fat thickness}$; $R^2 = 0.73$.

³In the gain.

Key Words: beef cattle, body composition, fat thickness

M257 Effects of trehalose on performance and morbidity of newly received beef steers. E. M. Domy, * C. H. Ponce, J. S. Schutz, and M. L. Galyean, *Department of Animal and Food Sciences, Texas Tech University, Lubbock.*

Trehalose is a disaccharide that has been previously associated with decreased oxidative stress in dairy cattle. The use of trehalose as a dietary supplement for newly received beef steers has not been investigated. Our objective was to evaluate the effects of trehalose concentration in the diet on performance and morbidity from bovine respiratory disease (BRD). One hundred and 24 steers (average initial BW = 182.1 kg ± 3.69 kg) purchased from auction markets in southwest Missouri were received, routinely processed (vaccinations, deworming, and metaphylactic antibiotic treatment), housed in 12 pens (10 to 11 steers/pen), and fed a 65% concentrate, steam-flaked corn-based receiving diet during a 28-d receiving period. Treatments were 0 (Control), 1, or 2% trehalose (% of dietary DM; Cargill Health and Nutrition, Minneapolis, MN). Initial BW did not differ ($P = 0.605$) among treatments. Similarly, final (d 28) BW was not affected by treatments ($P = 0.779$), and there were no differences ($P > 0.420$) among treatments for ADG, DMI, or G:F for d 0 to 14 or for the overall 28-d period. Only 7 steers were treated for BRD (5.6% total morbidity; 2, 1, and 4 steers from the Control, 1, and 2% trehalose treatments, respectively). Because of the low numbers of morbid steers, morbidity data were not analyzed statistically. Results from this experiment suggest neither positive nor negative effects on short-term receiving period performance or BRD morbidity with dietary supplementation of 1 or 2% (DM basis) trehalose in a steam-flaked corn-based receiving diet.

Key Words: newly received beef cattle, trehalose, bovine respiratory disease

M258 Performance of fattening steers on Marandu pasture supplemented with levels of total digestible nutrient in the water season. J. F. W. Koscheck¹, * J. T. Zervoudakis¹, L. K. Hatamoto-Zervoudakis¹, L. S. Cabral¹, A. A. Oliveira¹, J. M. B. Benatti¹, D. M. G. Carvalho¹, and R. P. Silva¹, ¹Federal University of Mato Grosso, Cuiabá, MT, Brazil.

This study aimed at evaluating the performance of cattle supplemented with different levels of total digestible nutrients (TDN), fattened on *Brachiaria brizantha* 'Marandu' pasture. The experiment lasted 84 d

and was conducted in an area with 4 paddocks of 1.45 ha, provided with covered water fountains and feed troughs. Twenty (20) uncastrated male steers with 24 mo of age and initial live weight average of 418.48 ± 6.95 kg were used. Animals were distributed in total randomized design with 4 supplements and 5 replicates. Supplements were composed of mineral mixture, ground grain corn, soybean hulls, roasted soybeans and urea. Supplements to levels of 800, 1600 and 2400 g/animal/day, containing respectively 500, 1000 and 1500g of TDN, called S500, S1000, S1500, were provided to fulfill 300 g of crude protein (CP)/animal/day, besides the control group which received only mineral mixture. Availability of forage mass, dry matter potentially digestible and the CP content of the forage were 5.45, 3.53 t/ha and 10.59%, respectively. For the supplements S1000, S1500, S500 and MM the animal weight gain was respectively 1.071 ± 0.062; 0.960 ± 0.102; 0.914 ± 0.094 and 0.671 ± 0.079 kg/day, statistical difference was verified through orthogonal contrast only between the supplement MM and the other supplements ($P < 0.05$). The increase in the level of supplementation, with consequent increase in the supply of extra TDN, was unable to generate positive response in animal weight gain, between supplemented animals. The common characteristic between the supplements was the amount of CP provided to each animal (300 g), which probably was the key point to get superior performance compared with animals not supplemented. The supply of multiple supplements that provide 300 g of CP/animal/day, for fattening cattle during the summer promotes additional gain of 311 g/animal/day in relation to the supply of mineral mix, which is important to get a short cycle of beef production.

Key Words: beef cattle, supplementation, weight gain

M259 Different supplementation strategies to grazing beef cattle in Brazil. H. O. A. Santana¹, H. J. Fernandes^{*1}, M. A. Rezende^{3,2}, G. L. D. Feijó², A. Aguiar⁴, E. P. Rosa¹, C. N. F. Guaraldo¹, and J. A. da Costa Lima¹, ¹State University of Mato Grosso do Sul, Aquidauana, MS, Brazil, ²EMBRAPA Beef Cattle Center, Campo Grande, MS, Brazil, ³Federal University of Grande Dourados, Dourados, MS, Brazil, ⁴University of Florida, Gainesville.

The objective of this study was to evaluate the effect of different supplementation strategies on the final weight and carcass characteristics of young Nellore bulls grazing *Panicum maximum* 'Mombaça' pastures during 426 d. Thirty-two bulls (287 ± 17.8 kg), were randomly distributed in 4 pastures, with 2.5 ha each. Treatments were: mineral supplementation (Control), continuous concentrate supplementation, concentrate supplementation on dry season, and compensatory gain (concentrate supplementation on rainy season). Concentrate supplement contained corn, soybean meal and urea (27.6% of CP and 79.8% of TDN) and was supplied at 0.5% of body weight. Mineral supplement was supplied ad libitum. At the beginning and at the end of the trial, animals were weighted (to calculate the average daily gain, ADG) and, at the end, ultrasound measurements of loin eye areas (LEA), fat thickness at the 12th rib (FTR) and at the P8 rump site (FT8) were taken. The effect of the concentrate supplementation, of the continuous or tactical (just in part of the year) concentrate supplementation, and of the season of the tactical concentrate supplementation were evaluated by the partition of the sum of squares of treatment in orthogonal contrasts. LEA and FTR did not differ (Table 1). Treatments did not affect the initial body weight ($P > 0.10$). Concentrate supplementation and continuous supplementation strategy increased the ADG and the FT8 of the animals. This result pointed to a greater sensitivity of the P8 site to assess the differences in fat deposition in the carcass, or to a difference in the site of fat deposition in animals submitted to different supplementation strategies.

Table 1. Final weight and carcass traits according to the supplementation strategy

| | Conc. suppl. | | | | P-value | | | |
|--------------------------------|--------------|------------|-------------------|------------|---------|-------|------------------------------|---------------------------|
| | Control | Dry season | Compensatory gain | Continuous | CV, % | Conc | Continuous or tactical conc. | Season of tactical suppl. |
| ADG, kg/d | 0.460 | 0.487 | 0.533 | 0.590 | 10.1 | 0.005 | 0.006 | 0.144 |
| Loin eye area, cm ² | 62.5 | 64.1 | 65.1 | 66.9 | 7.52 | 0.221 | 0.356 | 0.734 |
| Fat thickness, mm | | | | | | | | |
| at the 12th rib | 3.65 | 4.02 | 3.67 | 3.77 | 17.4 | 0.597 | 0.822 | 0.368 |
| at the P8 rump site | 3.15 | 3.25 | 3.78 | 4.53 | 18.2 | 0.037 | <0.01 | 0.184 |

Key Words: carcass, ultrasound, tropical production

M260 Determination of net energy requirements of growing Nellore cattle. S. L. Posada¹, A. L. C. C. Borges^{*2}, R. R. Nogueira¹, N. M. Rodríguez², R. R. Silva², C. G. Pancoti², and H. F. Lage², ¹Universidad de Antioquia, Medellín, Antioquia, Colombia, ²Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil.

In 1968 Lofgreen and Garrett introduced a net energy (NE) system designed for use in beef cattle, adopted by NRC (1996). Their equations were developed using *Bos Taurus* cattle. The objective of this study was to determine the NE requirements for maintenance and weight gain in growing Nellore cattle by calorimetry. Five Nellore bulls were confined at the Federal University of Minas Gerais (Belo Horizonte, Brazil), receiving *Cynodon* spp. hay, corn and soybean meal, from 200 to 450kg BW. Heat production (HP) was quantified by open circuit indirect calorimetry at 3 feeding levels: ad libitum, restricted and fasting. The Brouwer (1965) equation was used to estimate HP resulting from respiratory exchange and urinary nitrogen excretion: $HP \text{ (kcal)} = 3.866 O_2 + 1.200 CO_2 - 0.518 CH_4 - 1.431 N$. NE_m requirement was determined by linear regression between the log of HP and the metabolizable energy intake (MEI) for the ad libitum and restricted levels and also by measuring the fasting heat production (FHP) of the animals. The NE_g requirement was calculated by the difference between MEI and HP during ad libitum feeding. Data were analyzed by a repeated-measures design, using the PROC MIXED procedure of SAS (2001). The NE_m and NE_g requirements are shown in Table 1. Lofgreen and Garrett (1968) found 77 kcal/kg EBW^{0.75} for NE_m , which was lower than the values found. NE_m requirements showed a decreasing trend with increasing BW. That could be explained by lower weight proportion of organs and body protein as age increases. Retained energy (ER, NE_g) values (kcal/kg EBW^{0.75}) obtained were within the range described by Lofgreen and Garrett (1968).

Table 1. Energy requirements (in kcal/kg EBW^{0.75}) for maintenance (NE_m) and gain (NE_g) in experimental periods

| Item | Period | | | | | | | |
|----------|---------------------|-------|---------------------|-------|--------------------|-------|---------------------|-------|
| | 1 | | 2 | | 3 | | 4 | |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| NE_m^1 | 116.03 ^a | 15.03 | 92.36 ^b | 15.95 | 91.97 ^b | 10.68 | 84.14 ^b | 26.44 |
| NE_m^2 | 123.53 ^a | 25.64 | 93.92 ^b | 3.45 | 98.07 ^b | 7.02 | 83.19 ^b | 9.30 |
| NE_g | 11.54 ^b | 12.81 | 24.79 ^{ab} | 14.84 | 39.23 ^a | 18.34 | 26.41 ^{ab} | 13.45 |

^{a,b}In a row, means without a common letter differ ($P < 0.05$).

¹Obtained by regression.

²Obtained by respirometric technique.

Key Words: zebu, tropical conditions, respirometry

M261 Supplementation of fattening steers on Marandu pasture in the summer: intake and digestibility. J. W. K. Koscheck^{1,*}, J. T. Zervoudakis¹, L. K. Hatamoto-Zervoudakis¹, L. S. Cabral¹, A. A. Oliveira¹, J. M. B. Benatti¹, D. M. G. Carvalho¹, R. P. Silva¹, and R. G. F. Silva¹, Federal University of Mato Grosso, Cuiabá, MT, Brazil.

The objective was to evaluate intake and digestibility on fattening cattle on Marandu grass pastures supplemented with different levels of the total digestible nutrients (TDN). Four cattle, with an initial average weight of 512kg, rumen fitted and distributed in 4 paddocks, in 4x4 Latin square design, were used. The supplements were composed of mineral mixture, ground grain corn, soybean hulls, toasted soybean grain, and urea. Supplements to levels of 800, 1600 and 2400 g/animal/day, containing respectively 500, 1000 and 1500g of TDN, called S500, S1000, S1500, were provided to fulfill 300 g of crude protein (CP)/animal/day, besides the control group which received only mineral mixture. Each period lasted 17 d, 5 d for adaptation and forage collecting and 9 d for evaluation of the intake and digestibility. To estimate the intake, chromium oxide was used as external indicator and the indigestible NDF as internal indicator. Collecting of feces was made in 3 d at different collection times. SNK test was used for averages comparison. There was no statistical difference in the total dry matter intake (TDMI) and dry matter intake of pasture; however, there was a numerical increase in the TDMI with a trend to the replacement in the intake of forage for supplement. The intake of ethereal extract (EE) and non-fibrous carbohydrates (NFC) was higher for the animals fed with S1500 ($P < 0.10$), which can be explained by the increased supply of supplement.

Table 1. Intake and digestibility of cattle supplemented with levels of TDN

| | Supplements | | | | |
|---------------|-------------------|--------------------|--------------------|-------------------|--------|
| | MM | S500 | S1000 | S1500 | CV (%) |
| Intake, kg/d | | | | | |
| Total DM | 10.22 | 10.86 | 11.15 | 12.11 | 25.59 |
| Pasture DM | 10.15 | 10.06 | 9.55 | 9.71 | 27.98 |
| CP | 1.22 | 1.51 | 1.45 | 1.46 | 25.25 |
| EE | 0.41 ^b | 0.51 ^{ab} | 0.55 ^{ab} | 0.61 ^a | 27.06 |
| NFC | 1.46 ^b | 1.64 ^b | 2.03 ^b | 2.51 ^a | 31.70 |
| Digestibility | | | | | |
| OM | 53.2 | 52.1 | 54.1 | 54.5 | 9.91 |
| NDF | 49.8 | 49.7 | 50.2 | 50.6 | 9.86 |

^{a,b}Means within the row with different letters differ ($P < 0.10$).

Key Words: grazing animals, supplement

M262 Performance, feed efficiency and ultrasound carcass traits of Nellore cattle with different classes of residual gain. M. H. A. Santana^{*1}, R. C. Gomes², S. L. Silva¹, J. B. S. Ferraz¹, and P. R. Leme¹, ¹College of Animal Science and Food Engineering, University of São Paulo, Pirassununga, SP, Brazil, ²State University of Londrina, Londrina, PR, Brazil.

The residual gain (RG) was proposed as a measure that estimates the weight gain according to feed intake and body weight (Koch et al., 1963; J. Anim. Sci., 22:486). With the objective to verify the differences between RG classes in performance, feed efficiency and ultrasound carcass traits in Nellore cattle (bulls n = 141, 21-mo old 385 kg initial BW; steers n = 224, 20-mo old, 350 kg initial BW), we computed the average daily gain (ADG), dry matter intake (DMI), feed conversion ratio (F:G), residual feed intake (RFI) and the gain of ribeye area (GRE), gain of backfat thickness (GBFT) and gain of rumpfat thickness (GRFT) measured by ultrasound. Residual gain was calculated by regression of ADG in DMI, metabolic BW (BW superscript 0.75), contemporary

group, and sex. The animals were divided into 2 classes according to the standard deviation of RG (high > 0.5 SD and low < 0.5 SD). The RG class effect was analyzed by ANOVA and the means were compared with Tukey test with a 5% probability level. Only the DMI, as expected, did not differ ($P > 0.05$) between the RG classes as well as GREA. The high RG group had ($P < 0.05$) higher ADG, GBFT and GRFT and lower F:G and RFI when compared with low RG group. An improvement in the RG may increase the deposition of fat on the carcass, the weight gain and improving feed efficiency without affecting the feed intake.

Key Words: growth, *Bos indicus*, intake

M263 Effect of diet type on the expression of genes regulating ruminal epithelium function of cattle. A. K. Kelly^{*1}, S. M. Waters², K. Keogh^{1,2}, E. O'Shea^{1,2}, and D. A. Kenny², ¹*School of Agriculture and Food Science, University College Dublin, Dublin, Ireland*, ²*Teagasc, Animal Bioscience Department, Dunsany, Co. Meath, Ireland*.

The objective of this study was to investigate the effect of varying dietary concentrate to forage content on the expression of genes encoding for enzymes involved in the absorption and metabolism of VFA, ion transporters and transcription factors in ruminal epithelial tissue of cattle. Forty-eight Holstein-Friesian bull calves were assigned to one of 3 post-weaning dietary regimens; namely, grazed pasture only (n = 17; G); pasture plus 2 kg DM of concentrate (n = 16; GC) or ad-libitum concentrate plus 1 kg of straw (n = 15; C), fed indoors. Animals were slaughtered at 8 mo of age and ruminal epithelial tissue was harvested from the ventral sac of the rumen. Tissue from 10 animals per treatment was then selected for use in the current study. Total RNA was extracted and primers were designed to amplify specific regions of 25 genes involved in ruminal absorptive metabolism. Samples of rumen digesta were also collected at slaughter for VFA analysis, determined using gas chromatography. Ruminal VFA concentration was greatest for C and similar for G and GC. Acetic acid was highest for G and lowest for C (63.1 v 55.3 mol/mol VFA; $P < 0.05$). Conversely, propionic acid concentrations were greatest for C and lowest for G (32.1 v 23.2 mol/mol VFA; $P < 0.05$). The ratio of acetic:propionic was highest for G and lowest for C. There was no difference between dietary treatments ($P > 0.10$) for N-butyric, Iso-valeric or N-valeric acids. mRNA expression for Acetyl-CoA-Synthetase was greatest for C, intermediate for GS and lowest for the G treatments. Differences in expression was also detected between treatments ($P < 0.05$) for key genes involved in the ketogenesis pathway viz. Acetyl-CoA-Trans, HMGL, BDH1 and BDH2. An effect of diet type ($P < 0.05$) was also observed for genes involved in cholesterologenic homeostasis, namely ACAT2, HMGCS2 and ABCA1, with higher expression detected for C compared with GC, which in turn was higher than G. Interestingly, similar dietary effects were also observed for transcription factors PPAR- α and SREBP2 believed to regulate these biochemical events. Moreover, the relative expression values for the ion transporters NHE2, and NHE3 were greatest for C, lowest for G and intermediate for GC. These results suggest that the biochemical pathways involved in ion exchange and VFA metabolism, in particular ketogenesis and associated regulatory transcriptional coordinators were upregulated in rumen epithelial tissue, in a linear fashion, with increased concentrate allowance. This study provides further evidence for the elucidation of the molecular mechanism regulating ruminal absorptive metabolism.

Key Words: VFA metabolism, rumen, nutrient absorption

M264 Correlations between arrival plasma amino acid concentrations and feedlot performance and effects of arrival sex and antibiotic treatments in high-risk calves. C. L. Maxwell^{*1}, S. J. Terrill¹, J. W. Dillwith², R. D. Madden², M. L. May³, G. K. Kim³, S. L. Parr³, C. W. Booker³, C. R. Krehbiel¹, and L. O. Burciaga-Robles³, ¹*Department of Animal Science, Oklahoma State University, Stillwater*, ²*Department of Entomology and Plant Pathology, Oklahoma State University, Stillwater*, ³*Feedlot Health Management Services Ltd., Okotoks, AB, Canada*.

Data from 2 experiments was pooled and used to determine correlations between arrival plasma AA concentrations and 60 d feedlot performance, and the effects of arrival sex (Bull vs. Steer) and antibiotic treatment (Trt vs. No Trt) on arrival AA concentrations. Beef calves (n = 281; BW = 259 \pm 9.5 kg) were processed and administered metaphylactic treatment for control of BRD. Bulls were elastrated and all animals were allocated to individual feed intake systems (40 animals/pen; GrowSafe Systems, Ltd., Airdrie, Canada) and fed for 60 d. Cattle were observed by trained personnel for detection and treatment of disease. Twenty-three calves were administered an antibiotic treatment, and 33 bulls were elastrated. Pearson correlation coefficients were calculated using PROC CORR (SAS 9.3, Cary, NC) examining the relationship between arrival AA concentration and 60 d feedlot performance. The effects of sex and antibiotic treatment on AA concentration were analyzed using PROC GLIMMIX. Animal was the experimental unit, and the model included the fixed effect of treatment and the random effects of pen and sex nested within trial. For all cattle, glutamic acid had a negative correlation to DMI, ADG, and G:F (-0.185, -0.307, -0.272, respectively; $P < 0.05$) for the 60 d period. Serine, alanine, and 4-hydroxyproline had negative correlations ($P < 0.05$), and glycine, leucine, ornithine, and histidine had positive correlations ($P < 0.05$) to d 0-60 G:F. For calves treated, leucine and isoleucine concentrations tended to be increased ($P \leq 0.12$) compared with calves never treated. Calves that arrived as bulls had higher total, gluconeogenic, branched-chain, aromatic, and non-essential AA concentrations ($P < 0.05$) than those that arrived as steers. These data indicate that a relationship exists between arrival AA concentrations and feedlot performance, and AA concentrations are increased in bulls compared with steers. However, there appears to be no relationship between arrival AA concentrations and subsequent antibiotic treatment.

Key Words: amino acid concentration, BRD, feedlot performance

M265 Evaluation of the acid insoluble ash technique as a method for determining apparent diet digestibility in beef cattle. E. J. Mc Geough^{*1,2}, D. A. Kenny², and P. O'Kiely¹, ¹*Teagasc Animal & Grassland Research and Innovation Centre, Grange, Dunsany, Co. Meath, Ireland*, ²*School of Agriculture, Food Science and Veterinary Medicine, University College Dublin, Dublin, Ireland*.

The objective was to determine if the acid-insoluble ash (AIA) method provided accurate estimates of in vivo apparent diet digestibility compared with the standard total fecal collection (TFC) method. Twelve Holstein-Friesian steers, mean LW 328 (SD 27.3) kg, were assigned to 1 of 3 blocks on a descending LW basis and randomly allocated, from within block, to 1 of 4 diets based on either whole-crop wheat (WCW) or grass silage (GS) in a 4 \times 4 Latin square design. The 3 WCW silages were based (DM basis) on ratios of grain to straw plus chaff as follows: 11:89, 26:74 and 47:53. The fourth treatment was GS. Each period within the Latin square was 28 d, with all silages offered for ad libitum consumption for 15 d after which time, the amount of silage offered to each animal was limited to 0.90 of its ad libitum intake. A concentrate supplement (2.60 kg) was offered to each animal in a single feed daily.

For the last 10 d in each period diet digestibility measurements were undertaken. TFC was carried out at 08.00 h, with AIA fecal sampling carried out simultaneously. For the AIA method, fecal grab samples (200 g) were obtained per rectum and pooled for each animal at the end of the measurement period. All feed and fecal samples were assayed for DM, NDF, ADF, CP, and starch. The 2 methods were compared using graphical representation on an agreement plot and by computing a total deviation index ($TDI_{0.9}$) and coverage probability ($CP_{0.06}$). Computation was carried out using the SAS macro of Lin et al. (2002), available at <http://www.uic.edu/>. The $TDI_{0.9}$, which is an estimate of the deviation that covers 90% of the digestibility measurements, was 0.08 for apparent DM digestibility, with a $CP_{0.06}$ estimate of 0.75, indicating that 75% of the observations fell within the previously specified error limit of 0.06. Upon removal of GS from the analysis, the strength of the agreement between the 2 methods was increased ($TDI_{0.9} = 0.06$ and $CP_{0.06} = 0.89$). Thus, it may be concluded that the AIA method is a useful method to determine diet digestibility given the proportion of measurements that fell within the pre-specified range of acceptability.

Key Words: acid insoluble ash, total fecal collection, beef cattle

M266 Feedlot performance and carcass traits of Nellore cattle as affected by sex condition and frame size. S. L. Silva^{*1}, R. C. Gomes², M. N. Bonin¹, L. S. Martello¹, P. L. Alvarez¹, L. S. Oliveira¹, M. R. Mazon¹, J. C. M. Nogueira Filho¹, J. B. S. Ferraz¹, and P. R. Leme¹, ¹Universidade de São Paulo, Faculdade de Zootecnia e Engenharia de Alimentos, Pirassununga, SP, Brazil, ²Dep. Zootecnia, Universidade Estadual de Londrina, Londrina, PR, Brazil.

Use of non-castrated (NC) males for red meat production has been a common practice in Brazil because they grow fast, utilize feed more efficiently and show high-yielding and leaner carcasses when compared with castrated males (CM). The objective of this work was to investigate the effects of sex condition and frame size (FS) on feedlot performance and carcass traits of finishing *Bos indicus* steers and bulls. Nellore bulls (n = 119; 372 ± 32kg LW) and steers (n = 122; 351 ± 36 kg LW) averaging 20-mo old, were tested for feedlot performance, being fed high-grain diets (85% of concentrate) for 56 to 140 d. Individual DMI, ADG and G:F were recorded. At the beginning of each test, animals were weighed (LW) and hip height was measured to calculate FS. In 28-d intervals, animals were weighed and ultrasound scanned for determinations of LM area (LMA) and backfat thickness (BFT) between 12th/13th ribs. At the end of test period, animals were slaughtered and hot carcass weight (HCW) and kidney, pelvic and inguinal fat (KPIF) were registered. Animal FS ranged from 4 to 9. Data was analyzed by ANOVA with year (block), FS and sex as fixed effects and time on feed (test length) as covariate. At the beginning of feedlot period, NC were heavier (369 vs 351 kg), had greater LMA (61.6 vs 59.9 cm²) and lower BFT (0.5 vs 1.4 mm) than CM ($P < 0.0001$), respectively. Also had higher ADG (1.86 vs 1.58 kg/day), DMI (10.7 vs 10.3 kg/day) and G:F (0.176 vs 0.155 kg ADG/kg DMI) than CM ($P < 0.0001$). Steers had smaller HCW than NC (292.7 vs 320 kg, respectively) but they did not differ in dressing percentage (59.3%). Steers had higher KPIF (3.6 vs 2.8%) and BFT at slaughter (5.6 vs 4.4 mm) than NC, respectively, but they had greater final LMA than CM (79.8 vs 74.1 cm², respectively). FS was positively and linearly associated to initial and final LW, G:F and HCW ($P < 0.0001$) but did not affect other traits. Non-castrated and large FS finishing animals may be more profitable due to their greater weight gain and G:F. When fed high concentrate diets, NC Nellore males present carcass with adequate BFT to the meat industry.

Key Words: beef cattle, *Bos indicus*, feedlot

M267 Evaluation of a rapid determination of heat production and respiratory quotient in Holstein steers using the washed rumen technique. D. H. Kim^{*1}, K. R. McLeod¹, J. L. Klotz², A. F. Koontz¹, A. P. Foote¹, and D. L. Harmon¹, ¹University of Kentucky, Lexington, ²USDA-ARS, Forage-Animal Production Research Unit, Lexington, KY.

The objective of this study was to validate use of the washed rumen technique for rapid measurement of fasting heat production (FHP) and respiratory quotient (RQ), and compare this with heart rate (HR) and core temperature (CT). The experiment used 8 Holstein steers (322 ± 30 kg) under controlled temperature (21°C) as follows: 10 d diet adaptation, 1 d measurement of respiratory gases at 1.5 × NE_m (Unwashed rumen), 1 d measurement of respiratory gases at fasting (Washed rumen), and 7 d for re-establishing intake. Steers were offered alfalfa cubes top-dressed with a mineral pre-mix at 1.5 × NE_m. At the day of measurement the reticulorumen was washed and refilled with ruminal buffer (NaCl = 96; NaHCO₃ = 24; KHCO₃ = 30; K₂HPO₄ = 2; CaCl₂ = 1.5; MgCl₂ = 1.5 mmol/kg of buffer) that was gassed with a mixture of 75% N₂ and 25% CO₂ before incubation in the rumen. Mean daily CT between unwashed and washed rumen were not different (Table 1). Mean daily HR and HP were lower for washed rumen than for unwashed rumen ($P < 0.001$). RQ was lower for washed rumen and there was an interaction ($P < 0.001$) with sampling hour. To define the plateau of RQ, dependence of RQ rate and hour on unwashed and washed rumen was fitted by a one-phase decay equation. The plateau of RQ values were calculated at 0.87 ± 0.01 and 0.72 ± 0.01 for unwashed and washed rumen, respectively. The RQ decreased to approximately 0.7, by 8 h after washing the rumen. This approach may provide an alternative to the traditional 48 h fasting time, or measurements made during the third and fourth day after starvation. Applying the washed rumen technique may be more rapid and less stressful means to predict energy required for maintenance in cattle.

Table 1. Comparison of washed and unwashed rumen models

| Item | Unwashed | Washed | SEM | P-value | | |
|------------------------------|----------|--------|------|---------------|----------|--------|
| | | | | Treatment (T) | Hour (H) | T × H |
| CT, °C | 36.91 | 36.91 | 0.07 | ns | ns | ns |
| HR, beats/min | 57.62 | 45.30 | 1.01 | <0.001 | ns | ns |
| HP, kJ/kg BW ^{0.75} | 237.15 | 167.01 | 3.67 | <0.001 | ns | ns |
| RQ | 0.85 | 0.73 | 0.01 | <0.001 | <0.001 | <0.001 |

Key Words: fasting heat production, respiratory quotient, washed rumen

M268 Effects of lipid sources on intake and digestibility of beef cattle finished at pasture. I. P. C. Carvalho^{*1,3}, T. T. Berchielli^{1,2}, G. Fiorentini^{1,3}, J. F. Lage^{1,3}, Y. T. G. Salcedo¹, H. V. Brandt Filho¹, L. G. Rossi¹, C. S. Ribeiro Junior^{1,3}, and L. M. Delevatti¹, ¹Universidade Estadual Paulista Julio de Mesquita Filho, Jaboticabal, Brazil, ²INCT/CA member, Brazil, ³FAPESP Fundação de Amparo a Pesquisa do Estado de São Paulo, São Paulo, Brazil.

This study was carried out to evaluate the effects of lipid sources in supplements on intake and apparent digestibility of finishing beef steers kept at pasture. Forty-five Nellore steers (initial average body weight of 440kg) were assigned to 5 treatments on a completely randomized design. The animals were divided in to 10 paddocks (2 paddocks per treatment) of *Brachiaria brizantha* 'Xaraés'. Different lipid sources (linseed oil, palm oil, soybean grain and calcium salts; Lactoplus) was added to the supplements (100 g/kg DM) and offered at 1.0% body weight. The control treatment was composed of a corn and soybean meal supplement with no additional fat. All the concentrate contain 200 g/kg crude protein (CP) and 100 g/kg ether extract (EE) (except

the control supplement, which contained 30 g/kg EE). External markers were used to estimate fecal excretion (LIPE) and individual supplement intake (titanium dioxide, TiO₂). Calculation of dry matter intake was performed by using indigestible neutral detergent fiber (iNDF) as internal marker. The treatments were compared by analyzing variables using the GLM procedure (SAS 9.1, SAS Institute Inc., Cary, NC). Dry matter intake (DMI), pasture intake (PI) and supplement intake (SI) were not affected by the lipid sources ($P < 0.05$), with average values of 11.87, 6.87 and 4.81 kg/animal per day, respectively. The addition of linseed oil decreased dry matter and organic matter apparent digestibility ($P < 0.05$). This oil also lessened CP apparent digestibility ($P < 0.05$) relative to the other lipid treatments. Palm oil and Linseed oil presented a negative effect on neutral detergent fiber digestibility ($P < 0.05$). These results suggested that the addition of linseed oil on supplements for grazing beef cattle impair nutrient utilization, and the addition of palm oil decrease fiber degradation.

Table 1. Least squares means for apparent digestibility (g/100 g)

| | Control | Palm oil | Linseed oil | Calcium salts | Soybean grain | CV (%) | P-value |
|-----|--------------------|--------------------|--------------------|--------------------|---------------------|--------|---------|
| DM | 60.79 ^a | 59.83 ^a | 55.01 ^b | 61.13 ^a | 61.27 ^a | 5.06 | 0.0007 |
| OM | 65.57 ^a | 64.27 ^a | 60.53 ^b | 66.12 ^a | 65.89 ^a | 3.79 | 0.0006 |
| NDF | 59.23 ^a | 46.17 ^b | 48.20 ^b | 61.87 ^a | 62.04 ^a | 6.16 | <0.0001 |
| CP | 60.62 ^b | 67.86 ^a | 61.90 ^b | 68.99 ^a | 65.69 ^{ab} | 5.25 | <0.0001 |

^{a,b}Values in the same row followed by different letters differed on Tukey test ($P < 0.05$).

Key Words: beef cattle, marker, oil

M269 Nutrient mass balance and performance of feedlot cattle fed barley segregated by near infrared spectroscopy. E. M. Hussey, C. F. O'Neill, * R. E. Peterson, L. O. Burciaga-Robles, and M. L. May, *Feedlot Health Management Services Ltd., Okotoks, AB, Canada.*

Crossbred yearling heifers ($n = 9,617$, 32 pens, 269 ± 6 kg initial BW, days on feed = 229) were assigned randomly at feedlot arrival to one of 2 treatments: LOW or HIGH starch:NDF barley. Barley was determined to be HIGH (starch:NDF >3.25) or LOW (starch:NDF <3.25) at feedlot arrival based on values determined by Near Infrared Spectroscopy. The objective was to evaluate the impact of HIGH or LOW barley on feedlot performance, animal health, carcass characteristics, and N and P mass balance. Data were analyzed using the GLIMMIX procedure of SAS, with fixed effect of treatment and random effect of replicate. Intake was 0.2 kg/d greater ($P < 0.01$) for LOW barley compared with HIGH. Gain and final BW were greater ($P < 0.01$) for LOW on a live and carcass adjusted basis, but G:F was not different ($P \geq 0.30$). Carcass weight, 12th rib fat, and marbling score were greater ($P < 0.01$) for LOW barley compared with HIGH. Percentage of carcasses grading USDA Choice was greater ($P < 0.01$) and percentage grading USDA Standard was lower ($P < 0.01$) for LOW barley compared with high, whereas the percentage of carcasses grading USDA Prime or Select was not different ($P \geq 0.36$). Feeding LOW starch:NDF barley decreased ($P < 0.01$) the percentage of YG 2 carcasses, increased ($P < 0.01$) the percentage of YG 3 carcasses, and tended to increase ($P = 0.07$) the percentage of YG 4 carcasses. No differences ($P \geq 0.19$) in morbidity outcomes were observed. Overall mortality was similar ($P = 0.79$) between the 2 barley treatments, but mortality due to miscellaneous causes was greater ($P = 0.03$) for LOW compared with HIGH. Intake, retention, and excretion of both N and P were greater ($P < 0.01$) for LOW, but removal of N, P, DM removed, as well as N and P lost were not different ($P > 0.60$) between the 2 treatments. Feeding low starch:NDF barley improved

feedlot performance and carcass characteristics, had a slight negative impact on animal health, but had no effect on N and P losses.

Key Words: barley, feedlot performance, mass balance

M270 Development of a fecal starch index to predict the feeding value of barley grain for feedlot cattle. W. Z. Yang* and T. A. McAllister, *Research Centre, Agriculture and Agri-Food Canada, Lethbridge, AB, Canada.*

Fecal starch content is considered to be a good indicator of the utilization of grain by cattle fed high-grain diets. However, an accurate and rapid method for determining the starch content of feces is lacking. The objective of this study was to evaluate the relationship of in vitro gas production (GP) from feces with differing residual starch content to in vivo digestibility in an effort to develop a rapid indirect method to assess the residual starch content. Thirty-two fecal samples were collected from beef cattle in a replicated 4×4 Latin square study in which barley grain was processed so as to deliberately introduce variation in ruminal fermentation and total tract digestibility. Fecal samples were used as substrates in vitro. Gas production was recorded at 3, 6, 9, 15, 24, 36, 48 h and DM disappearance (DMD) was measured at 24 and 48 h of incubation. Pearson correlation coefficients of GP with fecal contents (N, NDF and starch) and in vivo feed digestibility were estimated using the CORR procedure of SAS. Ruminant contents (RI) or feces (FI) collected from 2 ruminally cannulated steers were used as inocula. Gas production (ml/g DM) was lower ($P < 0.01$) with FI than RI at 24 h (172 vs. 331) and 48 h (214 vs. 341). Dry matter disappearance was also lower ($P < 0.01$) with FI than with RI at 24 h (23 vs. 24%) and at 48 h (26 vs. 30%). In contrast, starch disappearance was higher ($P < 0.01$) with FI than with RI at 24 h (96 vs. 91%) and 48 h (99 vs. 97%). When using RI, there was no correlation of GP with either fecal starch content or in vivo starch digestibility, but there was a moderate correlation with fecal NDF content ($r = 0.45$; $P < 0.02$). However, when using FI, there was a positive correlation of GP with fecal starch content ($r = 0.5$; $P < 0.02$), and negative correlation with in vivo starch digestibility ($r = -0.48$; $P < 0.01$). The results suggest that GP from feces, using FI as an inoculum may be a good indicator on variation of residual energy value of feces. However, GP alone may not be a reliable indicator for assessing the residual starch content of feces.

Key Words: fecal starch, gas production, in vitro

M271 Effect of direct-fed microbials on utilization of ruminally degradable protein in receiving steers. N. M. Kenney,* C. A. Schaeffer, E. S. Vanzant, J. W. Lehmkuhler, D. L. Harmon, and K. R. McLeod, *University of Kentucky, Lexington.*

Direct-fed microbials (DFM) have been shown to alter rumen fermentation, thus response to DFM may be influenced by supply of degradable intake protein (DIP). One hundred ninety-two crossbred beef steers (280 ± 25 kg) were used to determine if DIP supply affects response to DFM in receiving cattle. Treatments were arranged in a 5×2 factorial, with 5 levels of DIP (80, 90, 100, 110, 120% of DIP requirement) fed with and without DFM (1 billion cfu/hd). DIP requirement was assumed to be 11% of TDN and diets were formulated to be isocaloric and meet or exceed metabolizable protein requirement. Differences in protein degradability were achieved by altering soybean meal:treated soybean meal (Amino Plus) and urea level. DFM consisted of a mixed bacterial culture, primarily *Lactobacillus acidophilus* and *Enterococcus faecium*. BW was recorded weekly and fecal pH was determined by rectal grab on d 7 and 14. There were no DIP or DFM effects on dry matter intake

across the 56 d study. A DFM by DIP interaction ($P=0.05$) was observed for ADG during the first 28 d of the trial, which resulted in a tendency for an interaction ($P=0.08$) over the 56 d trial. In the absence of DFM, ADG was similar across level of DIP, whereas in the presence of DFM, ADG increased with increasing level of DIP in a cubic ($P=0.08$) fashion. Growth efficiency (DFM×DIP, $P>0.10$) increased linearly ($P<0.05$) with increasing level of DIP through the first 28 d, however, this difference was not maintained over the entire 56 d ($P>0.10$). DFM increased growth efficiency ($P=0.05$) primarily due to increases in

efficiency over the first 28 d ($P<0.05$) of the study. A DFM by time interaction was observed for fecal pH ($P<0.05$). In the absence of DFM pH decreased from 6.71 to 6.62 on d 7 and 14, respectively. However, in the presence of DFM there was no change in pH over time (6.64). These data show that DFM improved growth efficiency across levels of DIP, however ADG response to DFM was dependent on DIP supply. This suggests that variable responses of cattle to DFM reported in the literature may be partially explained by DIP supply.

Key Words: cattle, direct-fed microbial, rumen degradable protein