Ruminant Nutrition: Beef: Supplements

858 Effects of residual feed intake classification and breed type on carcass characteristics, tenderness and value in feedlot heifers. J. W. Behrens*[1], R. K. Miller[1], J. C. Bailey[1], J. T. Walter[1], A. N. Hafla[1], E. D. Mendes[1], D. S. Hale[1], T. Machado[2], L. O. Tedeschi[1], and G. E. Carstens[1], *[1]Texas A&M University, College Station, [2]Texas A&M University at Kingsville, Kingsville.*

The objectives were to determine the effects of residual feed intake (RFI) classification and breed type on carcass characteristics, tenderness and value in Angus (AN; n = 184), Brangus (BN; n = 266), Simbrah (SI; n = 196), and Braford (BO; n = 241) heifers obtained over 3 years from Deseret Ranch. Each year, heifers were received in 2 groups; fall and spring (initial age and BW of heifers = 337 vs. 501 ± 86 d and 278 vs. 324 ± 48 kg, respectively). Heifers were fed a high-grain diet (ME = 3.08 Mcal/kg DM), and feed intakes measured using a GrowSafe system for 70 d. Thereafter, heifers were fed in group pens and harvested at an average backfat thickness of 1.2 cm in 2 groups. Within trial, RFI was computed as the difference between actual and expected DMI from the linear regression of DMI on mid-test BW $^{0.75}$ and ADG. Heifers were categorized into low, medium and high RFI groups based on ± 0.50 SD from the mean. Heifers were commercially harvested and USDA Yield and Quality grade characteristics obtained. Warner-Bratzler (WBSF) and Slice shear force (SSF) values were measured on top loin steaks after 1, 7 and 14 d of vacuum-packaged storage at 2°C. The model included fixed effects of RFI, breed, age and interaction terms and random effects of trial and pen. Low and medium RFI carcasses had lower adjusted fat thickness (AFT; $P = 0.001$) and lower yield grades (YG; $P = 0.004$) than high RFI heifers (1.19 and 1.22 vs. 1.30 ± 0.51 cm, respectively; 2.77 and 2.77 vs. 2.89 ± 0.10, respectively). RFI classification did not affect ($P > 0.05$) HCW, KPH, REA, marbling score or WBSF and SSF values. BO heifers had lighter HCW, smaller REA and higher ($P < 0.001$) YG than SI heifers, with AN and BN heifers being intermediate. Marbling scores were lower ($P < 0.001$) and d 1 WBSF was higher ($P < 0.001$) for BO and SI heifers compared with AN and BN heifers. In this study, breed type had more influence on carcass-quality traits than RFI classification. Heifers with low and medium RFI had lower YG than high RFI heifers, but RFI classification did not affect carcass marbling or tenderness traits.

Key words: breed, residual feed intake, tenderness

859 Effects of residual feed intake classification and breed type on feed efficiency and feeding behavior traits in heifers fed a high-grain diet. J. C. Bailey*, G. E. Carstens, J. T. Walter, A. N. Hafla, E. D. Mendes, L. O. Tedeschi, and R. K. Miller, *Texas A&M University, College Station.*

Objectives of this study were to evaluate the effects of residual feed intake (RFI) classification and breed on feed efficiency and feeding behavior traits in heifers fed a high-grain diet (ME = 3.08 Mcal/kg DM). Six trials were conducted over 3 yr with Angus (AN; n = 185), Braford (BO; n = 241), Brangus (BN; n = 266) and Simbrah (SI; n = 196) heifers from the Deseret Ranch; with 2 trials conducted each yr during the fall (n = 415) and spring (n = 473). Initial ages were 337 vs. 501 ± 86 d for heifers used in the fall (younger) and spring (older) trials. DMI and feeding behavior traits were measured for 70 d using a GrowSafe system. Within trial, RFI was calculated as the difference between actual and expected DMI from linear regression of DMI on ADG and mid-test BW$^{0.75}$, and heifers classified into RFI groups based on ± 0.5 SD from the mean. Low RFI heifers consumed less ($P < 0.0001$) DM (8.91 vs. 10.97 ± 1.04 kg/d), had lower ($P < 0.0001$) F:G (6.71 vs. 8.47 ± 1.81), but had similar initial BW (315.2 ± 48 kg) and ADG (1.38 ± 0.34 kg/d) compared with high-RFI heifers. Younger heifers with low RFI consumed 18.2% less DM than high-RFI heifers, whereas, older low-RFI heifers consumed 19.3% less DM than high-RFI heifers (RFI x age interaction; $P < 0.05$). Bunk visit frequency (48.5 vs. 63.4 ± 4.2 events/d) and duration (55.1 vs. 64.0 ± 3.6 min/d) were less ($P < 0.0001$) in heifers with low compared with high RFI. Likewise, low-RFI heifers had lower ($P < 0.005$) meal frequency (6.27 vs. 6.81 ± 0.80 events/d) and duration (139 vs. 157 ± 8.6 min/d) than high-RFI heifers. BO heifers had lower ($P < 0.001$) ADG (1.26, 1.45, 1.40 and 1.41 ± 0.07 kg/d) and DMI (9.50, 10.36, 10.13, 9.83 ± 0.43 kg/d) than AN, BN and SI heifers, respectively. F:G tended ($P < 0.13$) to be lower in SI compared with BO heifers (7.37 vs. 7.78), with AN and BN heifers (7.65 and 7.62 ± 1.8) being intermediate. In contrast, breed type did not affect RFI. Independent of breed, heifers with low RFI consumed 18.8% less DM and had fewer feeding behavioral activities than high-RFI heifers.

Key words: feeding behavior, residual feed intake

860 Analysis of the ruminant microbial ecosystem in cattle divergent for residual feed intake using next generation sequencing technology. C. A. Carberry*[1,2], D. A. Kenny[1], C. J. Creevey[1], and S. M. Waters[1], *[1]Animal and Bioscience Department, Animal and Grassland Research and Innovation Centre, Teagasc, Grange, Dunsany, Co. Meath, Ireland, [2]School of Agriculture, Food Science and Veterinary Medicine, University College Dublin, Belfield, Dublin 4, Ireland.*

As feed is one of the main input costs in beef production, improvements in feed efficiency are paramount to maintaining and increasing the profitability of the enterprise. There is now general agreement that the concept of residual feed intake (RFI) is the most appropriate approach for the selection of more energetically efficient beef cattle without compromising animal growth or performance. However, although suggested as having a putative role in determining the feed efficiency phenotype of an animal, little is known on whether the rumen microbial ecosystem differs between animals of different RFI phenotypes. The objective of this research was to analyze the rumen microflora in cattle divergent for RFI using 454 pyrosequencing technology. Beef heifers (n = 86), initially selected on the basis of sire EBV for RFI, were ranked on the basis of phenotypic RFI over an 80 d finishing period while consuming a 30:70 maize silage to concentrate diet. The 7 highest (HRFI; least efficient) and 7 lowest (LRFI; most efficient) ranking animals were selected for use in this study. Both groups had similar mean bodyweight and ADG at ranking but HRFI had, on average, 20% higher DMI. Following ranking on RFI all animals were offered a grass silage diet ad libitum for a 6 week period. Ruminal fluid was sampled at the end of this period using a specialized trans-esophageal sampling device. Total microbial DNA was isolated from the ruminal fluid and amplified using fusion primers including adaptors for titanium 454 sequencing and a region complementary to the bacterial 16s V3 region. Analysis of this data revealed many shared bacterial populations between the HRFI and LRFI animals, predominantly from the bacteriodales and clostridia clades. Most interestingly however, a significantly higher number of bacterial clusters were found to be unique to the rumen of HRFI compared with the LRFI animals. This suggests a correlation between microbial diversity and

feed efficiency in cattle and a mechanism through which differences in inherent ruminal microbial populations may influence feed efficiency in cattle.

Key words: residual feed intake, rumen bacteria, pyrosequencing

861 Association of myostatin with weight and carcass traits in crossbred heifers adjusted to different endpoints. S. K. Pruitt*, K. M. Rolfe, B. L. Nuttelman, W. A. Griffin, G. E. Erickson, and M. L. Spangler, *University of Nebraska-Lincoln, Lincoln.*

The objective of this study was to investigate a potential association of an inactive myostatin allele with performance and carcass traits using 60 individually fed crossbred heifers (395 ± 27 kg) genotyped for 0, 1, or 2 copies of the inactive myostatin (IM) (n = 25 homozygous active myostatin, n = 26 heterozygous, and n = 9 homozygous inactive myostatin, respectively). Heifers were fed a finishing diet that consisted of 52% corn, 35% wet distillers grains plus solubles, 8% hay and 5% supplement (DM basis) for 114 d. Ultrasound measurements of rump fat (RUMF), rib fat (RIBF), LM area (uLMA) and intramuscular fat percentage (IMF) were taken at 28 d intervals over the feeding period. Initial BW, final BW, DMI, and ADG decreased linearly ($P < 0.01$) with increasing copy number of IM. A linear decrease ($P = 0.03$) in G:F was observed as IM copy number increased. A quadratic decrease ($P < 0.05$) was observed in HCW, LM area, and marbling as well as a linear decrease ($P < 0.01$) in fat depth as IM copy number increased. Final ultrasonically measured traits, BW, and age were adjusted to common endpoints (BW, age, RIBF and RUMF) using regression estimates pooled within genotype class. Common endpoints were determined by the average value of each endpoint across genotype classes. Best-fit endpoints were determined by comparing Akaike′s Information Criterion (AIC) values. Given the strong correlation between RIBF and RUMF, BW was chosen for adjustment and was ranked second for AIC. Adjusted data were 4.69, 4.06, 2.35% for IMF (adjusted for RIBF); 90.3, 94.8, 110.3 cm^2 for uLMA (adjusted for age); 506, 485, and 453 kg for BW (adjusted for age); and 1.04, 0.74, and 0.46 cm for RIBF (adjusted to BW) for homozygous active, heterozygous, and homozygous inactive animals, respectively. Age adjusted to a constant BW and RIBF suggests that homozygous IM animals would require 26 and 84 more d on feed as compared with homozygous active animals to reach the same harvest BW and RIBF, respectively. This suggests that inactive myostatin genotype decreases IMF, G:F, RIBF, and final BW, while increasing uLMA.

Key words: beef cattle, compositional endpoints, myostatin

862 Effects of varying forage levels in diets containing whole flint corn and benefits of steam flaking the corn on finishing Nellore bulls performance, carcass characteristics, and liver abscesses. R. S. Marques[1], J. R. R. Dórea[1], A. M. Pedroso[2], A. W. Bispo[1], C. G. Martins[1], W. F. Angolini[1], and F. A. P. Santos*[1], *[1]University of Sao Paulo, Piracicaba, SP, Brazil, [2]Embrapa Cattle Southeast, Sao Carlos SP, Brazil.*

The objective of the present study was to determine the effect of increasing levels of sugar cane bagasse (0, 3, and 6% of diet DM) in finishing diets with whole flint corn and also the effect of processing flint corn as steam flaking on performance and carcass characteristics of zebu cattle. One hundred sixteen Nellore bulls with an initial BW of 373 kg were used in an 86-d randomized complete block design feeding trial. Animals were blocked by initial BW and randomly assigned to 20 pens. Animals were raised on pasture and were adapted to the feedlot diets during a 21 d pre-trial period. The final diets contained sugar cane bagasse, corn, urea, vegetable protein (soybean meal) and mineral and vitamin mix with monensin. Treatments were: 1) W0 (whole corn and no forage); 2) WC3 (whole corn with 3% sugar cane bagasse); 3) WC6 (whole corn with 6% sugar cane bagasse); 4) WC6-Opt (W6 with extra nitrogen from slow release urea - Optigen); 5) SFC6 (steam flaked corn with 6% sugar cane bagasse). Data were analyzed using the Mixed procedure of SAS (1999) with pen as experimental unit. There was a quadratic effect ($P < 0.01$) of forage level in whole corn diets for DMI, ADG, final BW and hot carcass weight. Compared with whole corn, steam flaked corn decreased DMI ($P < 0.01$), had no effect on ADG ($P > 0.05$) and improved feed efficiency (ADG/DMI) ($P < 0.01$). Carcass characteristics were not affected by treatments ($P > 0.05$) and liver abscesses incidence was negligible.

Table 1. Effects of roughage levels and corn processing

	WC0-	WC3	WC6	WC6-Opt	SFC6	Forage level[1]	SFC6 × WC[2]	SEM
DMI, kg	8.42	10.51	10.16	10.15	8.44	0.0001	0.0001	0.3
ADG, kg	1.19	1.58	1.55	1.50	1.55	0.0027	0.311	0.11
ADG/DMI	0.143	0.152	0.153	0.149	0.184	0.3272	0.001	0.014
HCW, kg	273.9	290.1	293.8	288.0	289.7	0.0048	0.514	6.64
Dressing, %	57.5	57.1	58.3	57.4	57.5	0.8209	0.901	0.67
REA, cm^2	77.5	79.6	79.5	79.5	79.4	0.283	0.817	1.47
FT, mm	4.45	5.29	4.81	5.04	5.1	0.2318	0.640	0.39

[1]Forage level: quadratic effect.

[2]Contrast SFC × WC diets.

Key words: corn, processing, feedlot

863 Evaluation of two complete-feed receiving diets. C. J. Schneider*[1], B. L. Nuttelman[1], K. M. Rolfe[1], W. A. Griffin[1], T. J. Klopfenstein[1], R. A. Stock[2], and G. E. Erickson[1], *[1]University of Nebraska, Lincoln, [2]Cargill Inc., Blair, NE.*

A receiving trial was conducted to evaluate effects of feeding 2 complete feeds on cattle performance during the receiving period. Crossbred steers (n = 965; BW = 261.1 ± 6.6 kg) were received over a 2-d period and processed within 12 h of arrival. Steers were blocked by arrival date and randomly allocated to pens within block based on processing order, resulting in 15 and 20 cattle per pen for blocks 1 and 2, respectively, with 17 pens per treatment. Treatments included a control receiving diet (35% alfalfa hay, 30% Sweet Bran, 30% dry rolled corn, and 5% supplement; 16.7% CP, 36.7% NDF) and 2 complete feeds. RAMP (21.9% CP, 41.9% NDF) and Test Starter (23.4% CP, 43.5% NDF) contained a high level of Sweet Bran with a minimal amount of forage and were formulated and provided by Cargill Inc., Blair, NE. All diets contained 27.6 mg/kg monensin and 26.5 mg/kg thiamine. Cattle were offered ad libitum access to treatment diets for 30 or 31 d and limit-fed a common diet (47.5% Sweet Bran, 23.75% grass hay, 23.75 alfalfa hay, and 5% supplement) for 5 d before collecting final BW to minimize variation in gut fill. Initial and final BW were averages of 2-d weights and a 4% pencil shrink was subtracted from final BW. Feeding RAMP increased ($P = 0.03$; Table 1) ADG when compared with the control diet. ADG for cattle fed Test Starter was not different ($P > 0.11$) from cattle fed control or RAMP. Final BW, DMI, and G:F were similar ($P > 0.14$) for all treatments. Starting cattle on RAMP is a viable alternative to starting cattle on a mixture of grain and forage.

Table 1. Performance of cattle fed RAMP, Test Starter, or a control receiving diet

Item	Treatment			SEM	*P*-value
	Control	RAMP	Test Starter		
Initial BW, kg	261	262	260	6.6	0.89
Final BW, kg	293	298	293	9.2	0.36
DMI, kg/d	6.08	6.30	6.26	0.11	0.14
ADG, kg	0.90[a]	1.03[b]	0.93[ab]	0.10	0.08
G:F	0.148	0.165	0.148	0.019	0.18

[a,b]Means within a row without a common superscript are different, $P = 0.03$.

Key words: beef cattle, feedlot, receiving

864 Rumen degradable protein supply effects microbial efficiency in continuous culture and growth in crossbred Angus steers. M. A. Brooks*[1,2], R. M. Harvey[2], N. F. Johnson[2], and M. S. Kerley[2], *[1]North Carolina State University, Raleigh, [2]University of Missouri - Columbia, Columbia.*

We hypothesized microbial efficiency (MOEFF) and output from ruminal fermentation was optimized when rumen degradable peptide (RDPep) supply was balanced with RDPep requirement. This study was conducted to measure response of varying RDPep supply on ruminal fermentation characteristics and steer growth. A continuous culture experiment was conducted with diets formulated to achieve a predicted RDPep balance (RDPep supplied/ RDPep required) of 0.0, 0.6, 1.8, and 3.0% DM and rumen degradable nitrogen (RDN) balance (RDN supplied/ RDN required) of −0.2% DM. Two additional treatments had RDPep balances of 0.0 and 1.8% CP with −0.5% DM RDN balance. Twenty-four single-flow fermenters (n = 6) were inoculated with rumen fluid and maintained anaerobically at 39°C with a 0.06 h^{-1} dilution rate. Inadequate RDN (0.5% RDN balance) decreased OM digestion and microbial N and increased rumen undegradable nitrogen ($P < 0.01$). MOEFF was also poorer in diets with 0.5% RDN balance and greatest when RDPep balance ranged from 0 to 1.83% ($P < 0.01$). Total VFA concentration decreased with 0.5% RDN balance while increasing levels of lactate were measured ($P < 0.01$). The second experiment was a growth study consisting of 4 diets varying in RDPep balance (0.52, −0.13, −0.48, −0.97% DM) but with similar and adequate RDN (~−0.7% RDN balance). Forty-nine yearling crossbred Angus steers (initial body weight ~370 kg) were assigned by weight into treatment groups (n = 12, with an extra steer in −0.48% RDPep treatment). Each treatment was divided into 3 pens with 4 animals per pen. Animals were maintained on treatment for 70 d with pen intake recorded daily and animal weights taken on d 0, 1, 21, 42, 70 and 71. Final body weight (average of d 70 and 71 weight) decreased linearly with decreasing RDPep ($P = 0.05$). DM intake did not differ among treatments (7.77 to 8.51 kg/hd/d; $P = 0.09$). Gain efficiency (G:F) and ADG displayed a quadratic effect with greater values occurring at the higher RDPep level ($P = 0.02$). We concluded balancing RDPep supply to requirement improved fermentation efficiency and output, which in turn improved animal performance.

Key words: peptide, microbial efficiency, nitrogen

865 Beef cow performance when fed cotton co-product and distillers grain blocks as a hay replacement. G. M. Hill*, A. N. Franklin, G. W. Stone, and B. G. Mullinix, *University of Georgia, Tifton.*

A compressed 250 kg block product (CPM; A. G. Daniel Co., Eastman, GA) containing cotton gin trash (59%), distillers dried grains with solubles (15%), wheat middlings (15%), a molasses product and minerals (11%), was evaluated as a hay replacement for cows. Angus cows (n = 52; AOD 5.9 ± 1.9 yr; initial BW 667.0 ± 53.67 kg) were ranked by BW, and randomly assigned to replicated treatments for 42 d. Initial and final cow BW were 2-d full BW means. A preliminary steer CPM intake study suggested that cow CPM intake might be elevated. Therefore, treatments included: free-choice Hay (HFC); 1 CPM block/6 cows every 4 d with hay (CPM4D); 1 CPM block/6 cows every 3 d with hay (CPM3D); free-choice CPM (CPMFC). The DM, CP, ADF, NDF (% DM basis) of 10 bermudagrass hay samples, were: 89.3, 9.4, 37.3, 77.2; and of 10 CPM samples, were: 89.8, 17.5, 37.3, 46.3. The TDN, K, S (% DM basis), NE_m and NE_g (Mcal/kg), in CPM were: 49.4, 2.4, 0.46, 0.91, 0.36. Cows were fed CPM blocks in bunks in a barn, and round-baled hay was weighed and fed free-choice in hay rings. The experiment began October 26, 2010, and the days pregnant at palpation on July 13, 2010, respectively, by treatment, were: 78.8, 87.7, 81.9, 78.7, SE 3.47, ($P < 0.27$). Cow ADG was greatest for CPM4D and CPMFC, intermediate for CPM3D, and lowest for HFC cows (Table; $P < 0.01$). Cow BCS tended to increase ($P < 0.97$) for cows fed CPM compared with HFC. The DMI of CPM in CPMFC was increased compared with CPM4D and CPM3D, and total DMI of CPMFC was 65% greater than HFC. All CPM treatments substantially increased cow BW gain in late pregnancy, while cost of providing CPM free-choice may be prohibitive.

Table 1

Item	HFC	CPM4D	CPM3D	CPMFC	SE
No. Cows	14	12	12	14	
Initial BW, kg	674.4	659.9	662.1	669.8	14.87
42-d ADG, kg[d]	0.39[c]	1.15[a]	0.88[b]	0.99[ab]	0.08
Initial BCS (Scale 1 to 9) [d]	5.34	5.51	5.39	5.46	0.18
42-d BCS Change[d]	0.13	0.18	0.26	0.24	0.22
CPM DMI, kg/d	0.00	9.52	11.91	22.31	
Hay DMI, kg/d	13.49	8.29	7.22	0.00	
Total DMI, kg/d	13.49	17.80	19.13	22.31	
Gain/feed	0.029	0.065	0.046	0.44	

[abc]Means with different superscripts differ ($P < 0.01$).

[d]Initial BW covariate effect ($P < 0.01$).

Key words: cotton, co-product, cow

866 Effects of energy supplementation frequency and forage quality on performance of replacement beef heifers. P. Moriel*[2], R. F. Cooke[1], F. N. T. Cooke[1], E. Alves[2], L. Custodio[2], D. W. Bohnert[1], J. M. B. Vendramini[2], and J. D. Arthington[2], *[1]Oregon State University–Eastern Oregon Agricultural Research Center, Burns, [2]University of Florida–Range Cattle Research and Education Center, Ona.*

The objective was to compare performance of beef heifers consuming forages differing in nutritional quality and offered an energy-based supplement at 2 different frequencies. Forty-eight Brahman × British heifers were ranked by initial BW and age and allocated to 16 drylot pens (3 heifers/pen). Pens were assigned to receive, in a 2 × 2 factorial arrangement, 1 of the 4 treatment combinations: 1) low-quality hay (LF; *Cynodon nlemfuensis* with 8% CP, DM basis) and daily supplementation (S7), 2) LF and supplementation 3x/wk (S3), 3) medium-quality hay (MF; *C. dactylon* with 12% CP, DM basis) and S7, 4) MF

and S3. Forages were offered ad libitum to heifers throughout the experimental period (d 0 to 120). Supplement was based on soybean hulls and offered at a daily rate of 2.2 (1.0% of initial BW) and 1.1 (0.5% of initial BW) kg of DM to LF and MF heifers, respectively. Heifer shrunk BW was obtained at the beginning and end of the experiment. Forage and total DMI were evaluated daily, from d 20 to 26, d 33 to 39, and d 46 to 52. Mean BW gain was greater ($P < 0.01$) for LF vs. MF heifers (0.34 vs. 0.19 kg/d, respectively). Mean forage DMI was greater ($P < 0.01$) for MF vs. LF heifers (3.6 vs. 2.6 kg/heifer/d) and for S7 vs. S3 heifers (3.4 vs. 2.9 kg/heifer/d). Total DMI was greater ($P < 0.01$) for S7 vs. S3 heifers (5.1 vs. 4.6 kg/heifer/d). Mean NE_m and NE_g intakes were greater ($P < 0.01$) for LF vs. MF heifers (5.8 vs. 5.0 and 3.0 vs. 2.4 Mcal/heifer/d of NE_m and NE_g, respectively) and for S7 vs. S3 heifers (5.6 vs. 5.2 and 2.8 vs. 2.6 Mcal/heifer/d of NE_m and NE_g, respectively). Mean CP intake was greater ($P < 0.01$) for MF vs. LF heifers (0.64 vs. 0.59 kg/heifer/d) and for S7 vs. S3 heifers (0.64 vs. 0.59 kg/heifer/d). In summary, independently of forage quality, replacement beef heifers offered an energy-based supplement daily had greater nutrient intake but similar BW gain compared with cohorts supplemented 3x/wk. Heifers consuming low-quality forage and supplemented at 1.0% of BW had similar DMI, reduced CP intake, but greater energy intake and BW gain compared with cohorts consuming medium-quality forage and supplemented at 0.5% of BW.

Key words: supplementation, forage, heifer

867 Impact of rumen digesta inoculation on feeding value of urea-molasses treated wheat straw. M. Sarwar*, M. A. Shahzad, and M. Nisa, *Institute of Animal Nutrition and Feed Technology, University of Agriculture, Faisalabad, Punjab, Pakistan.*

The study was conducted to examine the chemical composition of urea–molasses treated wheat straw (WS) fermented with bovine rumen digesta (RD). The WS treated with varying levels of urea (0, 2 and 4%) and molasses (0, 2 and 4%) was ensiled with 10% rumen digesta (on dry matter basis) for different fermentation periods (20, 30 and 40 d). Data were analyzed using completely randomized design with 3 × 3 × 3 factorial arrangement of levels of urea, molasses and fermentation time, respectively and means were separated by Duncan's multiple range test using general linear model procedure of SPSS. Fermented wheat straw (FWS), after each fermentation period, was analyzed for pH, dry matter (DM), crude protein (CP), true protein (TP), ammonia nitrogen (NH3-N), neutral detergent fiber (NDF) and acid detergent fiber (ADF). High ($P < 0.05$) pH, CP, TP, NH3-N and low ($P < 0.05$) NDF contents were observed with increase in urea level, however, DM and ADF contents remained unaltered. Increasing molasses level resulted in high ($P < 0.05$) CP, TP, NH3-N and low ($P < 0.05$) NDF contents were observed while increase in fermentation period resulted in high ($P < 0.05$) CP, TP and minimum ($P < 0.05$) NH3-N, NDF contents. The pH, DM, CP, TP, NH3-N and NDF contents were affected ($P < 0.05$) by urea × molasses interaction and urea × fermentation days interaction. The CP, TP, NH3-N and NDF contents were also influenced ($P < 0.05$) by molasses × fermentation days interaction, however, pH, DM and ADF contents remained unaffected. Similar trend was observed in urea × molasses × fermentation days interaction. The 4% urea and 4% molasses after 40 d of fermentation period indicated increase in CP and TP contents and decrease in NDF content of WS. The study found 4% urea and 4% molasses for 40 d fermentation period best combination for large-scale production of FWS to evaluate its feeding value for ruminants.

Key words: nutritive value, rumen digesta, wheat straw

868 Effect of sorghum grain supplementation on glucose metabolism 1: Bovine. M. Aguerre*[1], M. Carriquiry[2], A. L. Astessiano[2], C. Cajarville[3], and J. L. Repetto[1], *[1]Departamento de Bovinos, Facultad de Veterinaria, Universidad de la República, Montevideo, Uruguay, [2]Departamento de Producción Animal y Pasturas, Facultad de Agronomía, Universidad de la República, Montevideo, Uruguay, [3]Departamento de Nutrición Animal, Facultad de Veterinaria, Universidad de la República, Montevideo, Uruguay.*

Crossbred heifers (n = 12; 210 ± 42.5 kg), blocked by BW, were used to evaluate the effects of sorghum grain supplementation (0 vs. 1.5% BW, S0 vs. S1.5, respectively) on plasma glucose, insulin and glucagon concentrations and on hepatic expression of genes related to glucose metabolism. Heifers were fed ad libitum fresh *Lotus corniculatus* (31.8% DM, 12.4% CP, 41.8% NDF). At the end of treatments (31 d) blood samples were taken every 2 h from 0 to 6 h post-supplementation, to determine glucose by colorimetry and insulin and glucagon by RIA. Liver biopsies were collected to quantify abundance of pyruvate carboxylase (PC), phosphoenolpyruvate carboxykinase (PCK-1) and insulin receptor (IR) mRNA by SYBR-Green real-time PCR, using hypoxanthine-guanidine phosphoribosyltransferase as endogenous control. Data were analyzed with MIXED procedure (SAS). Glucose were greater in S1.5 than S0 (74.3 vs. 63.5 ± 9.88 mg/dL, $P = 0.004$) and the shape of the curves was similar over the 6 h post-supplementation. Insulin levels tended to be greater in S1.5 than S0 (12.2 vs. 8.33 ± 2.18 μUI/mL; $P = 0.084$), recording a 2-fold increase from 0 to 2h only in S1.5 group (6.96 vs. 15.0 ± 2.70 μUI/mL, $P = 0.050$). Glucagon concentrations were lower in S1.5 than S0 (58.0 vs. 66.9 ± 4.52, $P = 0.020$) but while glucagon decreased 4 h post-supplementation (77.6 vs. 56.9 ± 5.75 μUI/mL, $P = 0.002$) in the S0 group, glucagon increased in the first 2 h post-supplementation in the S1.5 (48.5 vs. 61.8 ± 6.16 μUI/mL, $P = 0.057$). The insulin/glucagon ratio tended to be greater in S1.5 than S0 (0.20 vs. 0.13 ± 0.03, $P = 0.084$). Plasma insulin and glucagon were correlated with each other (r = 0.60, $P = 0.032$) and insulin was correlated with OM intake (r = 0.67, $P = 0.013$). The IR and PC mRNA did not differ between treatments (14.2 vs. 12.1 ± 1.86 and 60.2 vs. 40.7 ± 7.44, for S0 and S1.5 respectively), but PCK-1 mRNA was lower in S.15 than S0 (15.4 vs. 28.4 ± 3.42, $P = 0.020$). The expression of PCK-1 was negatively correlated with plasma insulin (r = –0.86, $P = 0.001$). Sorghum supplementation increased glucose and insulin concentration and reduced glucagon and PCK-1 mRNA abundance. This would indicate an increased anabolism in supplemented animals.

Key words: hormones, liver mRNA, grazing cattle

869 Response to increased sorghum grain supplementation levels: Comparison between cattle and sheep. M. Aguerre*[1], C. Cajarville[2], and J. L. Repetto[1], *[1]Departamento de Bovinos, Facultad de Veterinaria, Universidad de la República, Montevideo, Uruguay, [2]Departamento de Nutrición Animal, Facultad de Veterinaria, Universidad de la República, Montevideo, Uruguay.*

Crossbreed heifers (n = 24; 210 ± 42.5 kg), and lambs (n = 24; 45.6 ± 6.2 kg), blocked by BW, were used to compare the response on OM intake and digestibility (OMI and OMD), ruminal pH, N–NH_3 and microbial protein synthesis (MPS) to increased levels of sorghum grain supplementation (0, 0.5, 1.0 and 1.5% BW). Heifers and lambs were fed ad libitum fresh *Lotus corniculatus* (31.8% DM, 12.4% CP, 41.8% NDF). After 21d, OMI was measured for 10d and all feces and urine were collected for 5d. The MPS was calculated from total urinary excretion of purine derivatives. Ruminal liquor samples were taken every 1h from 0 to 6h post-supplementation, to determine pH

and N-NH_3. Mean data values and linear regressions were compared among species with the MIXED procedure (SAS). Mean OMD did not differ between cattle and sheep (71.4 vs. 72.1 ± 0.98%; $P = 0.635$), but mean ruminal pH, N-NH_3 and MPSE were different between species (6.38 vs. 6.05 ± 0.10, $P = 0.056$; 21.8 vs. 37.1 ± 1.58 mg/dL, $P < 0.01$; 16.5 vs. 11.8 ± 0.68 g of MN/kg of DOMI, $P < 0.01$, for cattle and sheep respectively). No differences were detected on OMD, ruminal pH, N-NH_3 and MPS efficiency (MPSE) response to the increasing sorghum supplementation levels between species (Table 1). In contrast, OMI and MPS were differently affected in both species ($P < 0.01$). While in heifers OMI and MPS increased as sorghum supplementation increased, in lambs OMI and MPS decreased as the level of supplementation increased. Increasing levels of supplementation affected differently cattle and sheep. Therefore, both species should not be used as similar models for ruminant nutrition research.

Table 1

Item	Cattle	Sheep	P^1
OMI (% $BW^{0.75}$)	Y = 10.3 + 2.00X; $R^2 = 0.50$, $P < 0.01$	Y = 9.65 – 1.32X; $R^2 = 0.23$, $P = 0.02$	<0.01
OMD (%)	Y = 68.7 + 3.64X; $R^2 = 0.21$, $P = 0.03$	Y = 68.7 + 4.65X; $R^2 = 0.23$, $P = 0.02$	0.674
Ruminal pH	Y = 6.73 – 0.46X; $R^2 = 0.22$, $P < 0.01$	Y = 6.46 – 0.55X; $R^2 = 0.34$, $P < 0.01$	0.477
MPS (g MN/d)	Y = 71.6 + 10.2X; $R^2 = 0.26$, $P = 0.02$	Y = 16.5 – 4.43X; $R^2 = 0.28$, $P < 0.01$	<0.01
MPSE (g MN/kg DOMI)	Y = 18.4 – 2.70X; $R^2 = 0.20$, $P = 0.05$	Y = 13.9 – 2.80X; $R^2 = 0.21$, $P = 0.02$	0.954

[1]*P*-value of compared regression.

Key words: bovine, ovine, fresh pasture