

Ruminant Nutrition: Small Ruminant

M393 Blood biochemical constituents in growing lambs fed on orange pulp ensiled with exogenous enzymes. A. Z. M. Salem^{*1,4}, H. M. Gado², N. E. Odongo³, and B. E. Borhami¹, ¹Department of Animal Production, Faculty of Agriculture (El-Shatby), Alexandria University, Alexandria, Egypt, ²Department of Animal Production, Faculty of Agriculture, Ain Shams University, Cairo, Egypt, ³Animal Production and Health Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, International Atomic Energy Agency, Vienna, Austria, ⁴Centro Universitario UAEM-Temascaltepec, Universidad Autónoma del Estado de México, Estado de México, México.

Twenty-four Ossimi male lambs were used to evaluate effects of feeding ensiled orange pulp (EOP) in lamb diets either with or without addition of exogenous enzymes (ZADO of anaerobic bacterium origin-ENZ) on blood protein (g/100 mL), globulin (g/100 mL), albumin (g/100 mL), cholesterol (mg/100 mL), urea (mg/100 mL), serum glutamic-oxaloacetic transaminase (GPT, units/ml) and glutamic-pyruvic transaminase (GOT, units/ml) concentrations. Lambs (21.1 ± 1.01 kg of BW) were assigned to one of 3 groups of 8 animals/group in a randomized complete block design being: Control (0 g/kg EOP), EOP (Control with 150 g/kg EOP without enzymes) or EOP+ENZ (EOP with 5 g/kg of ZADO[®]). Feeding lambs with EOP diet did not affect blood protein, albumin, urea, GPT and GOT concentrations (Table 1), whereas addition of ENZ during ensilage of orange pulp increased blood globulin concentration ($P = 0.048$) and reduced cholesterol level ($P = 0.043$). Data suggested that addition of enzymes to the EOP could improve the animal immunity and health.

Table 1. Blood biochemical constituents of lambs fed diets containing ensiled orange pulp (EOP) in the presence (EOP+ENZ) or absence (EOP) of an exogenous enzymes mixture

	Diets			SEM	P-value
	Control	EOP	EOP+ENZ		
Protein	7.2	7.1	7.4	0.61	0.26
Globulin	52.5 ^b	54.6 ^{ab}	60.8 ^a	5.82	0.048
Albumin	3.8	4.0	3.9	0.32	0.34
Cholesterol	109.1 ^a	103.7 ^a	94.5 ^b	11.41	0.043
Urea	33.6	34.2	35.9	10.62	0.28
GPT	40.3	43.4	47.2	6.23	0.23
GOT	24.5	25.3	24.8	4.36	0.36

^{a,b}Means in the same row with different letters differ significantly ($P < 0.05$).

Key words: lambs, orange pulp, silage

M394 Effect of propionate on urea and glucose kinetics in sheep. U. Agarwal*, K. Somers, K. Bailey, Q. Hu, and B. J. Bequette, University of Maryland, College Park.

Feeding and post-ruminal infusion of propionate is known to increase N retention in growing ruminants, possibly through increasing urea recycling and/or gluconeogenesis. The aim of this study was to determine whether ruminal propionate increases urea recycling, gluconeogenesis or both in growing sheep. Wether sheep ($n = 6$, 32.5 kg BW), fitted with a rumen cannula, were fed to 1.8 × maintenance energy intake a pelleted ration (130 g CP/kg, 9.3 MJ ME/kg) and infused into the rumen with isoenergetic (1 MJ/d) solutions of either Na-Acetate (control) or Na-Propionate for 10-d periods in a balanced crossover design. [¹⁵N₂]Urea was continuously infused i.v. for the last 5 d, and

all urine and feces collected, and subsampled. Over the last 12 h, [¹³C₆] glucose was infused i.v. and hourly blood samples collected during the last 5 h. Compared with background (no infusion), Acetate infusion increased ($P = 0.07$) rumen acetate but decreased ($P = 0.07$) butyrate, whereas Propionate infusion increased ($P < 0.05$) rumen propionate. Dietary DM digestibility was not different (70%). Propionate infusion increased ($P < 0.05$) plasma urea concentration (4.1 vs. 3.4 mM). Urea synthesis (14.2 vs. 14.3 g urea-N/d), urinary urea excretion (10.2 vs. 9.5 g urea-N/d) and urea recycled to the gastrointestinal tract (4.3 vs. 4.6 g urea-N/d) were not different between Propionate and Acetate (control) infusions. Propionate infusion increased plasma glucose entry rate (3.7 vs. 4.4 g/kg BW/d, $P < 0.01$) and gluconeogenesis (2.44 vs. 3.1 g/kg BW/d, $P < 0.01$) but did not affect glucose (Cori) recycling. Under the dietary conditions of this study, infusion of propionate into the rumen did not affect urea synthesis and recycling compared with the isoenergetic control (Acetate), despite the fact that plasma urea concentration was higher with Propionate infusion. The increase in gluconeogenesis with Propionate infusion increased the supply of glucose for peripheral tissue metabolism and likely spared amino acids for protein synthesis.

Key words: isoenergetic, gluconeogenesis, urea kinetics

M395 Duodenal flow of nitrogenous compounds by wethers fed a fresh ryegrass-based diet intraruminally infused with *Acacia mearnsii* tannins. F. Hentz^{*1}, C. J. Härter², G. V. Kozloski¹, M. P. Mezzomo¹, and A. C. Fluck¹, ¹Universidade Federal de Santa Maria, Santa Maria, RS, Brazil, ²Universidade Estadual Paulista, Jaboticabal, SP, Brazil.

Four Polwarth × Texel wethers (30 ± 4.8 kg BW) fitted with chronic rumen catheter and duodenal cannula, housed in metabolic cages and offered fresh ryegrass (*Lolium multiflorum*) ad libitum (10% refusals) were used in a 4 × 4 Latin Square design experiment to evaluate the effects of ruminal infusion of *Acacia mearnsii* tannin extract (0.625 g/g of condensed tannins) on duodenal flow of N compounds and efficiency of microbial protein synthesis (EMPS). Treatments consisted of no tannin (0) or intraruminal infusion of 20, 40 or 60 g tannin extract/kg of DMI, according to the DMI of the previous day. Experimental periods lasted for 15 d (10 d adaptation, 5 d collection periods). Feed, orts, feces and urine output were recorded daily on d 10 to 15 and samples collected and composited within animal and period. On d 15, duodenal digesta samples (100 mL) were collected at 3 h intervals over a 24 h period and composited within animal and period. Duodenal flow of N compounds (g/d) was calculated by multiplying their concentrations in duodenal digesta (g/kg of DM) by duodenal flow of DM (g/d). Duodenal microbial N flow was estimated from urinary excretion of purine derivatives. Data were analyzed using the MIXED procedures of SAS. When the treatment effect by ANOVA was significant ($P < 0.05$) or tended to be significant ($0.05 < P \leq 0.10$), linear and quadratic effects of treatments were tested by regression analysis. Duodenal flow of total N ($P = 0.108$), α -amino N ($P = 0.305$) and ammonial N were not affected ($P = 0.568$) by tannins. There was a linear reduction ($P = 0.020$) in duodenal microbial N flow (from 6.2 to 2.9 g/d) whereas the EMPS was not affected linear ($P = 0.298$) or quadratically ($P = 0.143$) by the increasing levels of tannin infusion. In conclusion, although dietary inclusion of tannin extract from *Acacia mearnsii* in concentrations up to 60 g/kg of DMI significantly reduced microbial N flow,

it does not affect the amount of duodenal α -amino N supply and the EMPS in wethers fed a temperate grass-based diet.

Key words: condensed tannins, microbial N, sheep

M396 Effect of germinated and ensiling sorghum grain on digestion and ruminal fermentation by sheep. D. García¹, F. Castrejón¹, G. Mendoza², and L. Corona^{*1}, ¹Universidad Nacional Autónoma de México, Cd. Universitaria, DF, México, ²Universidad Autónoma Metropolitana, Xochimilco, DF, México.

To evaluate the influence of sorghum grain germinated and ensiling on nutrient digestion and ruminal fermentation of sheep, 5 Pelibuey lambs (38 ± 2.84 kg BW) with cannulas in the rumen and proximal duodenum were used, in a Latin square 5×5 . Treatments consisted of a basal finished diet containing 72% sorghum grain (% DM basis) as: 1) dry whole sorghum (DWS); 2) zero days germinated sorghum and ensiled for 42d, (GSE (G0)); 3) 1d GSE (G1); 4) 3d GSE (G3); 5) 5d GSE (G5). G1, G3 and G5 showed higher ruminal OM digestion ($P < 0.01$, 25.6%), ruminal starch digestion, RSD ($P < 0.01$, 25.6%) and ruminal NDF digestion, RNDFD ($P = 0.17$, 4.31%) but smaller protein efficiency, PE ($P < 0.05$, 18.65%) and postruminal OMD ($P < 0.05$, 9.88%) compared with DWS (percentages are the differences between treatments). G1, G3 and G5 had higher RNDFD ($P < 0.05$, 14.63%), but smaller RSD ($P < 0.10$, 5.20%) and PE ($P < 0.05$, 18.04%), compared with SG0E. The treatments G1, G3 and G5 showed bigger total digestion of OM ($P < 0.05$, 3.42%), total starch digestion, TSD ($P = 0.18$, 2.12%) and total nitrogen digestion, TND ($P < 0.10$, 3.65%) compared with DWS and this higher TOMD ($P = 0.11$, 2.61%), total NDF digestion, TNDFD ($P < 0.10$, 24.79%) regarding SG0E. The TSD ($P = 0.13$, 2.9%) was higher for G0 and TNDFD was lower ($P < 0.05$, 27.62%) compared with DWS. The increasing of germinated days, decrease (lineal effect, $P < 0.05$) TSD. The digestible energy DE (Mcal/kg) values were higher for G1, G3 and G5 ($P < 0.05$, 4.39%) compared with DWS. The ruminal pH was bigger ($P < 0.05$, 5.78%) for G1, G3 and G5 compared with DWS. The germination days increased (lineal effect, $P < 0.01$) acetate and reduced propionate (lineal effect, $P < 0.01$). Germination days increased (lineal effect, $P < 0.05$) methane production. It was concluded that the treatments with germinated sorghum and ensiled presented higher total digestion of OM, starch, N, DE and ruminal pH compared with whole sorghum grain, due mainly to an increment of the ruminal digestion. When increasing the days of germination decrease the starch digestion. The best treatment in terms of digestion of starch, ruminal pH and energy value was G1.

Key words: digestion, germinated sorghum, lambs

M397 Concentration of some elements in blood serum of non-lactating goats in a subtropical region of Southwest of México State. A. Olmedo, R. Rojo, A. Z. M. Salem, J. Cedillo-Monroy*, J. Morales-Díaz, J. L. Tinoco-Jaramillo, J. L. Martínez-Benitez, and F. Vázquez-Armijo, Centro Universitario UAEM-Temasaltepec, Universidad Autónoma del Estado de México, Temascaltepec, Estado de México, México.

A study was conducted to determinate the P, Ca, Mg, K, Na, Cu and Zn nutritional status of grazing nonlactating goats during 2 different season (dry and rainy of 2008) in 4 localities (Tejupilco, Amatepec, Luvianos and Tlatlaya) at south-western of México State. Eighty-four nonlactating goats (>2 calving, BW 39 ± 8), were sampled before morning feeding. Blood mineral concentration were assayed and data were analyzed using one way ANOVA test; significant differences between

means were tested by Tukey. Amatepec region registered the higher ($P < 0.01$) P concentration (4.79 mg/dL). Ca concentration was higher ($P < 0.01$) during rainy season (11.20 mg/dL), than dry period (9.54 mg/dL). There were no differences ($P > 0.05$) among season*localities. Luvianos showed the highest ($P < 0.01$) Na value during dry season (411.76 mg/dL) and Tejupilco presented the lowest values at the same season (322.0 mg/dL). K concentration was different ($P < 0.01$) during dry season. Tlatlaya showed the highest ($P < 0.01$) K value (29.50 mg/dL) and Tejupilco had the lowest (17.31 mg/dL). Tlatlaya recorded the highest ($P < 0.05$) serum Cu concentration during dry season compared with rainy season (0.192 vs. 0.080 mg/dL, respectively). The rest of regions, showed similar Cu concentration and ranged between 0.082 and 0.111 mg/dL. Zn concentration showed the same trend as most of minerals. The interaction season*localities, was highly significant ($P < 0.0004$), with Luvianos that showing higher concentration during dry season (0.117 mg/dL) versus rainy season (0.056 mg/dL), whereas for the rest of regions had a different concentration (from 0.059 to 0.096 mg/dL). P and Ca from the 4 regions in both seasons had low values, suggesting deficiency of these elements. K and in particular Na, were above normal levels reported in the literature. Based on results for Cu and Zn, nonlactating goats could be have reproductive problems due to the deficient or marginal levels in blood serum.

Key words: mineral status, blood serum, nonlactating goats

M398 Exogenous phytase effects on performance of weaned Dorper x Pelibuey lambs. G. Buendía-Rodríguez¹, S. S. González-Muñoz^{*2}, G. D. Mendoza-Martínez³, L. Y. Bernal-Zamora³, R. Basurto-Gutiérrez¹, M. M. Crosby-Galván², and J. J. A. Méndez-Romero⁴, ¹CENIDFyMA INIFAP, Ajuchitlán, Querétaro, México, ²Colegio de Postgraduados, Montecillo, Estado de México, México, ³Universidad Autónoma Metropolitana-Xochimilco, México DF, ⁴Universidad La Salle Bajío, Guanajuato, México.

The objective of this study was to evaluate the effect of an exogenous phytase (FINASE, AB Enzymes, from *Trichoderma reesei*; 40,000 FTU/g) on in vitro residual phosphorus concentration and performance of 30 weaned 3/4 Dorper \times 1/4 Pelibuey lambs (12.12 ± 1.46 kg BW). In vitro treatments were: 0 and 0.12 mg phytase per g of sorghum, corn gluten meal (CGM), alfalfa hay and experimental diet (70% ground sorghum grain, 16.9% CGM, 12% alfalfa hay, 11% calcium carbonate). The experimental design was completely randomized and Tukey test ($P \leq 0.05$) was used to determine differences for residual P concentration (%) between 0 and 0.12 mg phytase: 1) at 24 h (incubation), 0.086^a and 0.050^b sorghum, 0.259^a and 0.119^b CGM, 0.365 and 0.240 alfalfa, 0.276^a and 0.240^b diet; 2) at 48 h, 0.054 and 0.048 sorghum, 0.178 and 0.161 CGM, 0.198^a and 0.131^b alfalfa, 0.237^a and 0.211^b diet. For the performance trial (60 d) lambs were fed the experimental diet and 0, 6 or 12 g/t phytase (treatments). The experimental design was completely randomized (10 lambs per treatment), data collected over time was analyzed as repeated measurements using the MIXED option of SAS, and means were compared with the Tukey test ($P \leq 0.05$). Variables were average daily gain (ADG), dry matter intake (DMI), feed conversion (FC), apparent DM digestibility (DMD), plus P fecal excretion (PFE). Phytase did not change ($P \geq 0.05$) ADG (251, 294 and 266 g/d), DMI (905, 1119 and 975 g/d) or FC (4.06, 4.37 and 3.94). However, phytase addition increased ($P \leq 0.05$) DMD (72.34^b, 82.54^a and 82.57^a %) and PFE (1.01^b, 1.09^{ab} and 1.26^a g/d). Therefore, it may be concluded that apparent DM digestibility as well as phosphorus fecal excretion were affected when an exogenous phytase was added to a 70% sorghum grain diet, fed to weaned Dorper \times Pelibuey lambs during 60 d.

Key words: phytase, weaned lambs, performance and fecal phosphorus

M399 Calcium propionate and grain level effects on performance, ruminal variables and plasma glucose of finishing lambs.

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The aim of this trial (42 d) was to evaluate the effect of calcium propionate and grain level on performance, ruminal variables and plasma glucose concentration in 32 finishing Criollo lambs (28.14 ± 2.34 kg initial BW). The experimental design was completely randomized with a factorial arrangement of treatments 2×2 (55 and 65% grain; 0 and 1% calcium propionate). Grain was a 50:50 mixture of corn and sorghum grain. Data collected over time were analyzed using MIXED procedure (SAS) and treatment means were compared with Tukey test ($P \leq 0.05$). There were no differences ($P \geq 0.05$) between treatments for DMI, ADG, feed conversion, rib eye area and ruminal pH. Carcass yield was increased ($P \leq 0.06$) in lambs fed 65% grain without calcium propionate (52.79 vs. 50.62%) and 55% grain with calcium propionate (52.48 vs. 50.06%). Ruminal concentration of propionate was increased ($P \leq 0.05$) in lambs fed 55 or 65% grain plus calcium propionate. However, concentration of acetate or butyrate in the rumen and plasma glucose did not change ($P \geq 0.05$). Therefore, it may be concluded that calcium propionate could partially replace the energy from the grain on diets for finishing lambs.

Key words: calcium propionate, finishing lambs, weight gain and carcass variables

M400 Effects of zilpaterol hydrochloride and genotype on performance of finishing lambs. F. Montoya¹, R. Castañeda¹, S. S. González-Muñoz*², G. Buendía-Rodríguez¹, R. Basurto¹, P. Partida¹, and H. Jiménez-Severiano¹, ¹*CENIDFyMA INIFAP, Ajuchitlán, Querétaro, México*, ²*Colegio de Postgraduados, Montecillo, Estado de México, México*.

Zilpaterol hydrochloride (zilpaterol), a β -adrenergic agonist, has been approved for finishing cattle, but few data are available for lambs. Therefore, the objective of this study was to determine the effects of zilpaterol and genotype on performance of 28 finishing lambs during 32 d. Genotypes were Pelibuey \times Blackbelly and Pelibuey \times Dorset, and lambs (32.7 ± 4.9 kg BW) were randomly assigned to experimental diets (16% CP and 2.75 Mcal ME/kg DM): Control (no zilpaterol); diet plus 6 ppm zilpaterol. Variables evaluated were ADG, DM intake (DMI), feed efficiency (FE; ADG/DMI) and final BW (FBW). The statistical model included zilpaterol and genotype effects and interaction; besides, initial BW was used as a covariable. Data collected over time was analyzed as repeated measurements using the MIXED option of SAS; and LS means are shown. Zilpaterol \times genotype interactions were not significant ($P \geq 0.05$). There was no effect ($P \geq 0.05$) of zilpaterol on ADG (315 vs. 318 g/d; SEM = 0.012), DMI (1.57 vs. 1.55 kg/d; SEM = 0.031), FE (0.200 vs. 0.205; SEM = 0.007) and FBW (42.7 vs. 42.4 kg; SEM = 0.38) for control and zilpaterol diets, respectively. Regarding genotype, Pelibuey \times Dorset lambs showed a higher ($P \leq 0.05$) ADG (0.336 vs. 0.284; SEM = 0.012), DMI (1.62 vs. 1.55; SEM = 0.031) and FBW (43.4 vs. 41.8 kg; SEM = 0.38) as compared with Pelibuey \times Blackbelly. Therefore, the results of this trial suggest that addition of zilpaterol did not change performance of finishing lambs, but there were differences between lamb genotypes.

Key words: finishing lambs, genotype, zilpaterol