T494 Effects of short-term inclusion of mixed fish and sunflower oils in finishing diet on carcass characteristics and performance of fat tailed Afshari lambs. H. R. Mirzaei Alamouti*, T. Khademi, M. H. Shahir, and M. Hajilo, *Department of Animal Science, University of Zanjan, Iran.*

An experiment was conducted to determine the effects of unsaturated fatty acids supplementation on growth performance and carcass characteristics of finishing lambs. Thirty-two finishing Afshari lambs (initial weigh 58 ± 5 kg and 8 mo age) were used in a completely randomized design with 4 treatments (slaughtered in time series) and 8 lambs/treatment for the final 30 d before slaughter. The slaughter times were d 0 (first day after adaptation period), 10, 20 and 30 after beginning of experiment. The lambs individually fed to the basal diet (80% concentrate; 65% barley grain and 11% soybean meal and 4% mineral and vitamin supplement, and 20% alfalfa hay) and daily fed with 60 g sunflower oil and 40 g fish oil. Body weight changes and daily feed intake were recorded. Blood samples, ultrasonography (back fat and Longissimus muscle thickness) and rumen fluid was taken on the last day of each periods. Cold and warm slaughter weight, dressing percentage, fat yield, pH, moisture loss, chemical composition, and visceral organs mass were measured. The results of this study were revealed that body weight, back fat and Longissimus muscle thickness, for d 0, 10, 20 and 30 after allocating to high oil supplemented diets was 59.20, 62.45, 65.26, and 69.07 kg; 4.8, 5.09, 5.36, and 4.79 mm; 24.41, 24.28, 25.90, and 30.38 mm; respectively. Warm and cold carcass weight and rumino-reticlum mass increased during time. Oil supplementation decreased tail weight to carcass weight ratio from 0.17 to 0.12 and also improved feed conversion ratio. Plasma concentration of cholesterol was highly increased by oil supplementation and was significantly different among the experimental diets ($P < 0.01$). This experiment showed that short-term inclusion of mixed fish and sunflower oils in final days of finishing lambs diet can improve carcass characteristics and performance of lambs.

Key Words: unsaturated fatty acid, carcass characteristic, finishing lamb

T495 Growth, hepatic enzymes and carcass characteristics of lambs fed diets containing increasing levels of crude glycerin. D. M. Polizel[1], R. S. Gentil[1], E. M. Ferreira[1], R. A. Souza[1], A. P. A. Freire[1], M. C. A. Sucupira[2], and I. Susin*[1], *[1]Escola Superior de Agricultura Luiz de Queiroz (ESALQ)/USP, Piracicaba, SP, Brazil, [2]Faculdade de Medicina Veterinária e Zootecnia (FMVZ)/USP, São Paulo, SP, Brazil.*

Crude glycerin is a high energy by-product of biodiesel production. However, some impurities may be present in it including methanol and salts. Methanol can impair liver function.The objectives of this trial were to determine the effects of partial replacement of corn by crude glycerin on growth, hepatic enzymes and carcass characteristics of lambs fed high-concentrate diets. Fifty (40 males and 10 females) White Dorper × Santa Ines lambs were assigned to a randomized complete block design, defined by initial BW, sex and age. Lambs were penned individually and fed, during 56 d (2 periods of 28-d), a TMR composed of 90% concentrate. Diets were isonitrogenous (15.7 ± 0.3% CP, DM basis) and the increasing levels of crude glycerin (83.6% glycerol and 397 mg of methanol/kg, DM basis) were 0, 5, 10, 15 or 20%. Lambs were weighted and blood samples were collected on d-0, d-28 and d-56. Average daily gain (ADG), feed efficiency (FE) and dry matter intake (DMI) were determined in each period. At the end of the 56-d, all ram lambs were slaughtered for carcass characteristics evaluation. Data were analyzed using the MIXED procedure (SAS Inst. Inc.). Orthogonal polynomials for diet responses were determined by linear and quadratic. Replacing corn by crude glycerin did not affect ADG (0.29, 0.29, 0.30, 0.31 and 0.28 kg), DMI (1.03, 1.02, 1.04, 1.08, 1.00 kg/d), FE (0.28, 0.28, 0.29, 0.28, 0.28) and body weight on d-28 (29.3, 29.3, 29.3, 29.2, 28.4 kg) and d-56 (38.9, 38.7, 39.0, 39.2, 38.2 kg). There was a diet and period interaction for DMI. In the second period (d28-d56) a quadratic effect for DMI (1.11, 1.15, 1.18, 1.25, 1.11, kg/d) was observed. Hepatic enzymes (aspartate aminotransferase and gamma glutamyltransferase) activity and carcass characteristics were not affected by crude glycerin addition to the diet. Crude glycerin can be used to replace up to 20% of corn (DM basis) in high-concentrate diet of lambs without detrimental effects on performance, hepatic enzymes and carcass characteristics.

Key Words: co-product, glycerol, sheep

T496 Effect of supplementation with dried citrus pulp, urea, and DDGS on reproductive performance of goats. Mayra A. Liñan Gonzalez[1], Hugo Bernal Barragan*[1], Fernando Sanchez Davila[1], Rogelio A. Ledezma Torres[1], Miguel Cervantes Ramirez[2], and Braulio Valles de la Mora[3], *[1]Universidad Autonoma de Nuevo Leon, San Nicolas de los Garza, Nuevo Leon, Mexico, [2]Universidad Autonoma de Baja California, Mexicali, Baja California, Mexico, [3]Universidad Nacional Autonoma de Mexico, Martinez de la Torre, Veracruz, Mexico.*

The objective of this study was to evaluate the effect of supplementation with 2 agroindustrial byproducts and urea, on body weight, serum glucose and BUN, as well as reproductive performance and blood progesterone of 56 goats of a commercial farm in Northeastern Mexico, grazing mixed thornscrub vegetation, including browse species, grass, forbs and Opuntia spp. (3.6 to 15.5% crude protein (CP) and 27.0 to 69.3% NDF), with daily access to shelter. Goats were blocked by breed (Nubian, Alpina and Saanen), age (1.5 to 2.5 years), parity (1 to 3), and body weight, and were randomly assigned among blocks either to T1: No supplementation; or to individually receiving 300 g/d of T2: dried citrus pulp (DCP, 4.9% CP, 20.0% NDF); or T3: DCP+Urea+DDGS (17.7% CP, 26.0% NDF); or T4: DCP+DDGS (15.4% CP, 29.2% NDF; n = 14 goats/treatment). Supplementation lasted 28 d in July–August 2014 (outside the natural breeding season). Beginning on d 13, a 9-d oestrus synchronization protocol was conducted applying 50 µg GnRH on d 13 and 22, and 75 µg PGF2α on d 20. Oestrus was observed utilizing teaser bucks, and goats were fixed-time transcervically inseminated 16 h after the second GnRH dose, using fresh processed and evaluated semen of 2 randomly assigned sires. Blood samples were collected by venipuncture of jugular vein on d 1, 6, 12, 20, 22 and 26. Glucose and BUN were colorimetrically analyzed. Progesterone was measured by ELISA. Results were analyzed by ANOVA and Chi-squared. Supplemented goats lost less BW ($P < 0.05$) than control animals. Serum glucose (42.3 ± 0.7 mg/dL) was similar ($P > 0.05$) among treatments. Goats in T1 and T4 had higher BUN values than T2 (mean 27.6 *vs* 25.2 mg/dL; $P < 0.05$). No differences were detected among treatments in oestrus appearance. Fertility rate of T2 and T3 (53 – 57%) was numerically better than in T1 and T4 (35 - 43%). Goats in T1 had on d 22 higher ($P < 0.05$) progesterone values than others. In conclusion, supplementing 300 g

of DCP and DCP+Urea+DDGS during 28 d helped avoid loss of BW and improved fertility of goats.

Key Words: goat, dried citrus pulp, dried distillers grains with solubles

T497 Effect of feed restriction on protein metabolism of Saanen goats of different sexes. Nhayandra C. D. Silva*, Izabelle A. M. A. Teixeira, Carla J. Härter, Simone P. Silva, Amélia K. Almeida, Diogo C. Soares, and Kléber T. Resende, *Unesp Univ Estadual Paulista, Jaboticabal, São Paulo, Brazil.*

The objective of this study was to evaluate the effect of feed restriction on protein metabolism of 84 Saanen goats (26 intact males, 27 castrated males and 31 females) with initial BW of 30,3 ± 0,87 kg. At the beginning of the experiment 8 intact males, 9 castrated males and 13 females were slaughtered with 30 kg of BW to estimate their initial body composition. The remaining 18 goats of each sex were assigned to 3 levels of feed restriction (ad libitum, 25% and 50% of feed restriction), with 6 goats per sex-feeding level (3 × 3 factorial). Animal sets (1 goat per sex-feeding level) were slaughtered when BW of ad libitum goats was 45 kg. Blood samples were collected every 14 d, in a total of 7 blood collections (98 d of experimental period). In these samples we evaluated total protein, albumin, urea, creatinine, triiodothyronine (T3) and IGF-1. Data were analyzed using Proc Mixed of SAS. Intact males presented lower body protein retention (kg) regardless the level of feed restriction ($P = 0.020$). Intact males fed ad libitum and with 50% of feed restriction had greater serum levels of creatinine in the blood (0.88 mg/dL and 1.28 mg/dL respectively; $P = 0.014$). Females fed ad libitum had lower urea levels (42.08 ± 1.83 mg/dL) than intact (51.1 ± 1.83 mg/dL) and castrated males (48.2 ± 1.81 mg/dL) however, when subjected feed restriction (25% and 50%), females increased serum levels of urea, whereas males had an opposite behavior. The feed restriction and sex did not affect serum albumin and total protein levels ($P > 0.05$). Intact males fed ad libitum and 25% feed restriction showed greater plasma levels of IGF-1 than females and castrated males ($P = 0.018$), but when fed 50% restriction, the IGF-1 concentration were similar between all sexes (85.0 ± 9.89 ng/mL). Plasma levels of T3 were similar in females and castrated males (1.57 ng/mL) and greater than in intact males (1.43 ng/mL; $P = 0.001$). The levels of IGF-1 and T3 in the blood showed a linear decrease with the increase of feed restriction ($P < 0.0001$). The feed restriction changed the protein metabolism in females and males. Pubertal males were not able to keep protein synthesis during feed restriction.

Key Words: dairy goat, gender, metabolic profile

T498 Female goat kids change their energy metabolism when subjected to feed restriction. Nhayandra C. D. Silva*[1], Izabelle A. M. A. Teixeira[1], Carla J. Härter[1], Fernanda O. M. Figueiredo[1], Rafael F. Leite[1], Moaceli M. Freire[2], and Kléber T. Resende[1], *[1]Unesp Univ Estadual Paulista, Jaboticabal, São Paulo, Brazil, [2]Universidade Federal de Alagoas, Maceió, Alagoas, Brazil.*

The objective of this study was to evaluate the effect of sex and feed restriction on energy metabolism of 72 Saanen goat kids (24 intact males, 24 castrated males and 24 female) with initial BW of 15.8 ± 0.17 kg. At the beginning of the experiment 6 animals of each sex were slaughtered with 15 kg of BW to estimate their initial body composition. The remaining 18 kids of each sex were assigned to 3 levels of feed restriction (ad libitum, 25% and 50% of feed restriction), with 6 kids per sex-feeding level (3 × 3 factorial). Animal sets (1 kid per sex-feeding level) were slaughtered when BW of ad libitum kids was 30 kg. Blood samples were collected from all animals every 10 d, in a total of 7 blood collections (70 d of experimental period). In these samples, we evaluated glucose, cholesterol, NEFA, β-hydroxybutyrate (B-HB) and aspartate aminotransferase (AST). Data were analyzed using Proc Mixed of SAS. Females presented greater fat deposition (31.6 ± 0.36% EBW) than castrated males (24.7 ± 0.36% EBW) and intact males (11.5 ± 0.36% EBW) regardless the level of feed restriction ($P < 0.0001$). Serum glucose was similar in intact and castrated males throughout the experiment (67.4 ± 4.59 mg/dL). As the feed restriction level increased, serum AST activity of castrated males decreased ($P = 0.0251$) in a ratio of 4.3% for those subjected to 25% of feed restriction and 15.8% for those under 50% feed restriction compared with castrated fed ad libitum. In females, AST activity was higher in those subjected to 50% feed restriction (83.83 ± 4.96 U/L), whereas in intact males remained unchanged regardless of the restriction regimen (80.9 ± 4.95 U/L). The highest B-HB concentration was observed when animals were subjected to the maximum level of feed restriction (0.129 mmol/l) followed by those fed ad libitum (0.103 mmol/L) and restricted by 25% (0.090 mmol/L; $P < 0.0149$). Sex and feed restriction did not influence NEFA and cholesterol blood levels ($P > 0.05$). Goat kids of different sex act physiologically different when subjected to feed restriction. Females changed all their glycolytic metabolism to keep the fat deposition even when they are subjected to feed restriction.

Key Words: growth, metabolic profile

T499 Effects of restricted diet access on intake and performance by dairy goats in mid- to late lactation. Nhayandra C. D. Silva*[1,2], Ryszard Puchala[1], Terry A. Gipson[1], Yoko Tsukahara[1], Tilahun Sahlu[1], and Arthur L. Goetsch[1], *[1]American Institute for Goat Research, Langston University, Langston, OK, [2]UNESP, Universidade Estadual Paulista, Department of Animal Science, Jaboticabal, SP, Brazil.*

Restricting periods of dietary access of lactating dairy goats could influence level or efficiency of production and offer different management options. Therefore, objectives of the experiment were to determine effects of offering feed at different times of the day and for various lengths on intake and milk yield and composition of 50 Alpines (15, 25, and 10 of parity 1, 2, and ≥3, respectively) with initial BW of 55.2 kg (SE = 0.95) and 125 d-in-milk (SE = 3.0). A 40% forage diet (20% alfalfa pellets, 10% cottonseed hulls, and 10% coarsely ground grass hay) was given free-choice in Calan gate feeders during a 2-wk covariate period and subsequent 12-wk experiment. Treatments were feed access continuously (C), during the day for 8 h (D) or night for 16 h (N), and for 2 or 4 h/d with equal lengths after milking in the morning and afternoon (2H and 4H, respectively) (10 animals/treatment). Neither DMI (2.05, 1.87, 2.08, 1.91, and 1.87 kg/d; SE = 0.107) nor milk yield (1.77, 1.75, 1.67, 1.64, and 1.68 kg/d for C, D, N, 2H, and 4H, respectively; SE = 0.098) were influenced by treatment ($P > 0.05$), with milk yield (1.83, 1.84, 1.60, and 1.54 kg/d in periods 1, 2, 3, and 4, respectively; SE = 0.051) but not DMI differing among periods. Treatment also did not influence ADG (32, 22, 49, 9, and 20 g; SE = 13.0) or body condition score during the study (2.35, 2.32, 2.24, 2.26, and 2.34; SE = 0.052) and at the end (2.49, 2.39, 2.32, 2.33, and 2.42; SE = 0.054). However, there were treatment effects on milk concentrations of fat (3.78, 3.64, 3.54, 3.75, and 3.21%; SE = 0.126) and protein (2.91, 2.88, 2.88, 2.84, and 2.58% for C, D, N, 2H, and 4H, respectively; SE = 0.049). Energy-corrected milk (3.5% fat, 3.2% protein) in kg/d (1.70, 1.66, 1.58, 1.53, and 1.52 kg/d; SE = 0.101) and relative to DMI (0.79, 0.84, 0.78, 0.81, and 0.81 kg/kg for C, D, N, 2H, and 4H, respectively; SE = 0.073) were similar among treatments. In conclusion, dairy goats in mid- and late lactation possess considerable flexibility in eating behavior that may

allow for incorporation of limited feed access regimens in management systems for most efficient facility utilization.

Key Words: dairy goat, feed access, milk production

T500 Effect of sodium monensin on rumen metabolism in lambs fed high-forage diets. Mariana F. Westphalen*[1], Daniel M. Polizel[2], Marcelo H. Santos[2], Renan G. Silva[2], Analisa V. Bertoloni[1], Gabriela B. Oliveira[1], Thiago S. Andrade[2], Vinicius N. Gouvea[2], Marcos V. Biehl[2], and Alexandre V. Pires[1,2], *[1]University of São Paulo, Piracicaba, São Paulo, Brazil, [2]University of São Paulo, Pirassununga, São Paulo, Brazil.*

The objectives of this trial were to determine the effects of increasing doses of sodium monensin on rumen metabolism of lambs fed high-forage diets. Five wethers (BW 70.5 ± 2.8 kg), cannulated in the rumen, were used in 5 × 5 Latin Square design. Animals were fed daily and diet was composed of coastcross hay. Sodium monensin were offered twice a day and doses were 0 (control), 8, 16, 24 or 32 mg/kg DM, corresponding to 0, 40, 80, 120 and 160 mg of Rumensin 200. The delivery vehicle of the set dosage of monensin was 20 g of ground corn per 1 kg DM intake. Every period of experiment lasted 20 d and rumen fluid was collected in the last day, every 3 h, starting prior feeding, 3, 6, 9 and 12 h after feeding. Short-chain fatty acids (SCFA) and pH were analyzed as repeated measures over time. Protozoa concentration was determined only 3 h after feeding. Data were analyzed using MIXED procedure (SAS Inst. Inc.) and LSMEANS option was used to generate individual means. Orthogonal polynomials for diets responses were determined by linear and quadratic effect. There was a quadratic response for acetate (78.22, 78.25, 78.65, 77.62, 76.27 m*M*/100 m*M*, $P = 0.03$), propionate (14.81, 14.59, 15.07, 15.60, 16.90 m*M*/100 m*M*, $P = 0.02$), isobutyrate (0.66, 0.59, 0.53, 0.56, 0.64 m*M*/100 m*M*, $P = 0.02$) and acetate:propionate ratio (5.30, 5.35, 5.24, 5.02, 4.54, $P = 0.02$). However, there was an interaction ($P < 0.05$) between diet × hour for acetate:propionate ratio. The inclusion of sodium monensin decreased acetate:propionate ratio during 9 and 12 h. There was a linear response for valerate (0.76, 0.66, 0.59, 0.60, 0.59 m*M*/100 m*M*, $P = 0.03$) and pH (6.57, 6.61, 6.46, 6.43, 6.49, $P = 0.05$). Butyrate (4.42 ± 0.06 m*M*/100 m*M*), isovalerate (1.01 ± 0.04 m*M*/100 m*M*), total SCFA (85.58 ± 1.14 m*M*/L) and protozoa concentration (1.88 ± 0.22 × 10^5/mL) were unaffected ($P > 0.05$) by the experimental diets. Sodium monensin doses above 16 mg/kg DM provided an increase in the molar proportion of propionate over acetate, consequently reducing the acetate-to-propionate ratio and pH.

Key Words: ionophore, propionate, acetate:propionate ratio

T501 Either intramuscular or submucous vulvar administration of HCG positively affects the reproductive outcomes of anovulatory Alpine goats in Northern Mexico. Karen Isabel Tapia-Robles*[1], Cesar Alberto Meza-Herrera[2], Jessica Maria Flores-Salas[1], Alan Sebastian Alvarado-Espino[1], Vicente Homero Gonzalez-Alvarez[1], Evaristo Carrillo-Castellanos[3], Juan Manuel Guillen-Muñoz[1], Francisco Gerardo Veliz-Deras[1], and Rafael Rodriguez-Martinez[1], *[1]Universidad Autonoma Agraria Antonio Narro, Torreon, Mexico, [2]Universidad Autonoma Chapingo, Unidad Regional Universitaria de Zonas Aridas, Bermejillo, Durango, Mexico, [3]Instituto Tecnologico de Torreon, Torreon, Mexico.*

This study was performed to determine whether vulvar administration HCG, either intramuscular (IM) or submucous (SM), influence the reproductive response of goats during the natural anestrous season in Northern Mexico. Anovulatory Alpine goats (n = 30) under intensive conditions were divided in 3 homogeneous groups (n = 10, each) based on body weight (BW; 37.36 ± 8.48 kg) and body condition (BC, 1.96 ± 0.32). On June 29th, 20 mg of progesterone was applied to all of the goats; 24-h later (d 0), 7.5 mg of $PGF_{2\alpha}$ IM was also applied. Group 1; (GC) received 0.5 ml of isotonic saline solution IM, group 2 (GIM) received 100 UI of hCG of IM and group 3 (GSM) received 100 UI of HCG SM. Estrous activity was registered twice per day from d-0 to d-5 using a male; females accepting mating were considered to be in estrus. Ovulation activity was assessed on d-10 by detecting the presence of at least one corpus luteum while gestation was determined on d-45 both throughout a transrectal ultrasonographic scanning (7.5 MHz). The percentages of females in estrous, ovulating and pregnant were compared with chi^2. While the control group did not depict any response in either variable, treated groups depicted an important reproductive response without differences ($P > 0.05$) between treated groups regarding estrus behavior (GIM 100% *vs* GSM 100%), ovulatory activity (GIM 70% *vs* GSM 100%), and pregnancy rate (GIM 70% *vs* GSM 100%). To conclude, regardless of the administration route of 100 IU of HCG, either i.m. or s.m., both treatments were equally efficient to induce sexual activity with significant reproductive outcomes in Alpine goats during the natural anestrous season in northern Mexico (25°N).

Key Words: anestrous goats, HCG, administration route

T502 Performance of Santa Inês meat lambs receiving cactus pear (*Nopalea cochenillifera*) in substitution of Tifton hay with or without access of water. Alma V. Cordova Torres[1], Leonardo S. Knupp[2], Antonello Cannas*[2], Giustino Gaspa[2], José T. Araújo Filho[1], Ariosvaldo N. Medeiros[1], Neymar L. Alves[3], and Roberto G. Costa[1], *[1]Programa de Pós Graduação em Ciência e Tecnologia de Alimentos, Universidade Federal da Paraíba, João Pessoa, Paraíba, Brasil, [2]Dipartimento di Agraria, University of Sassari, Sardinia, Italy, [3]Departamento de Zootecnia, Universidade Federal de Alagoas, Rio Largo, Alagoas, Brasil.*

This work aimed to study the performance of Santa Inês meat lambs receiving different levels of inclusion of cactus pear (*Nopalea cochenillifera*) in substitution of Tifton (*Cynodon* dactylon) hay. The trial was conducted using 48 Santa Inês male lambs at 100 d of age, with average initial weight of 18.75 ± 0.46 kg. Diets were formulated to be isoproteic and isoenergetic. Animals had ad libitum access to feed. The experiment was carried out as a completely randomized factorial design (3 × 2), with 3 levels of substitution of Tifton hay with cactus pear (30%, 50% and 70%), subdivided in 2 groups, with or without access of water, and a control treatment. DMI significantly differed among treatments ($P < 0.001$) and the interaction among levels of cactus and access of water were not significant for all variables ($P > 0.05$). The equations to estimate DMI and the ADG in the diets with cactus pear were: DMI = $1572.3 - 17.8x - 112.8y + 0.07x^2 + 1.78xy$ ($R^2 = 0.63$); ADG = $145.3 + 1.2x + 15.5y - 0.02x^2 - 0.10xy$ ($R^2 = 0.29$), being x = level of inclusion of cactus pear in the diet (30, 50, 70%) and y = animals with (1) or without (0) access of water. In contrast, the equations to predict the DMI and the ADG including the control treatment with the group that had access of water were: DMI = $897.3 + 7.8x - 0.16x^2$ ($R^2 = 0.40$); ADG = $109.2 + 3.2x - 0.04x^2$ ($R^2 = 0.43$), being x = diet control and levels of cactus (0, 30, 50, 70%). The maximum value of DMI was 1.1 kg/day and the minimum was 0.7 kg/day, obtained for the group receiving 30% of cactus without access of water and 70% without access of water, respectively. The ADG was different among treatments ($P < 0.05$) ranging between 177.8 g to 106.8 g for the group with 30% of cactus in the diet with access of water and the control treatment, respectively. Feed efficiency was affected only by treatments, being the group that received 70% of

cactus in the diet with access of water the most efficient (0.19 g). In conclusion, cactus pear is recommended at 30% (with access of water) or 50% (without access of water) of substitution of Tifton hay, resulting in ADG of 178 or 157 g/day, respectively.

Key Words: cactus, dry matter intake, weight gain

T503 Influence of supplementing lamb with dried algae + live yeast product on growth and blood metabolites during summer. Ekin Sucu*[1], Duygu Udum Küçüksen[2], and Nazmiye Günes[2], *[1]Department of Animal Science, Faculty of Agriculture, Uludag University, Bursa, Turkey, [2]Department of Biochemistry, Faculty of Veterinary Medicine, Uludag University, Bursa, Turkey.*

Endocrine and immune system stimulation by Algae is an active area of research. Thus, the current case conducted to examine the impact of an dried algae (Schizochytrium limacinum) and live yeast product (*Saccharomyces cerevisiae* CBS 493.94; 3.0×10^{10} cfu) on lamb performance and blood metabolites during summer (mean temperature humidity index 75.5). Lambs were blocked by weight and randomly assigned to receive either control ration (n = 20) based on wheat grain and sunflower meal or a algae derived supplement with live yeast product (n = 20) in a crossover design with two 21-d experimental periods. Supplement top dressed 1×/d at a rate of 5 g/head/d. Daily pen dry matter intake were recorded and lambs were weighed weekly throughout the trial to determine daily weight gain and feed efficiency. Blood samples were collected from the individual animals during both periods at the beginning of the treatment period (d 0) and on the last day (d 21) of trial. Data were analyzed with the repeated measures PROC MIXED procedure of SAS (SAS Inst. Inc. Cary NC). Overall, Algae+ live yeast supplement increased final live weight and average daily gain ($P < 0.05$). However, no differences were noted between treatments for average dry matter intake ($P = 0.24$) or feed efficiency ($P = 0.23$). Plasma glucose (98.47 vs. 84.97 mg/dl) and insulin (64.14 vs. 29.26 ng/mL) concentrations were higher ($P < 0.05$) while total plasma cholesterol concentration tended to be lower ($P = 0.09$; 58.22 vs. 61.68 mg/dL) in Algae+ live yeast-fed lambs relative to control animals. However, plasma non-ester fatty acid ($P = 0.68$), total protein ($P = 0.55$), blood urea nitrogen ($P = 0.58$), lipopolysacharide binding protein ($P = 0.89$), diamine oxidase ($P = 0.17$), malondialdehyde ($P = 0.49$) and glutathione peroxidase ($P = 0.44$) concentrations were unaffected by supplementation. Results of this study indicate that algae supplement influences productivity and alter bioenergetics in growing lambs during summer. This study was supported by the Scientific Research Project Council of Uludag University, Project Number: KUAP(Z)-2013/46.

Key Words: algae, blood metabolite, lamb performance

T504 Net energy and protein requirements for growth of Moxotó goats grazing in the semiarid region of Brazil. Marcos J. Araújo*[1], Ariosvaldo N. Medeiros[2], Carlo A. T. Marques[1], Roberto G. Costa[2], Francisco F. R. Carvalho[3], and Jacira N. C. Torreão[4], *[1]Federal University of Piauí, Bom Jesus, Piauí, Brazil, [2]Federal University of Paraíba, Areia, Paraíba, Brazil, [3]Federal Rural University of Pernambuco, Recife, Pernambuco, Brazil, [4]Colégio Técnico de Bom Jesus, Bom Jesus, Piauí, Brazil.*

Indigenous goats play an important role in the semiarid region of Brazil as a biological resource with great genetic variability and historical value. They are raised in the traditional manner because they are rustic animals, commonly used for milk and meat production. Therefore, understanding their nutritional requirements is important for a successful nutrition system because animals fed properly will more efficiently convert the nutrients ingested in products. The objective of this study was to determine net energy (NE_g) and protein (NP_g) requirements for growth of 36 male Moxotó goat kids (15.69 ± 0.78 kg initial BW), grazing in the semiarid region of Brazil. Four kids were slaughtered at the beginning of the experiment (baseline group, 15.37 ± 0.30 kg BW) and the remainder (n = 32) were allocated randomly to one of the 4 levels of concentrate supplementation (treatments groups: 0, 0.5, 1.0 and 1.5% BW), with 8 kids per group. When the animals in the 1.5% BW treatment group reached 25 kg BW, the animals in the other treatment groups were also slaughtered. The individual whole empty body was weighed, ground, mixed and sampled for chemical analyses. We used the comparative slaughter method to assess body composition and calculate the nutritional requirements. Linear regressions were used to determine the relationship between the shrunk BW and the empty body weight (EBW). The allometric equations were calculated using the relationship between the amount of fat, energy and protein and the EBW. Body composition varied from 156.40 to 171.52 g of protein, from 65.20 to 138.44 g of fat and from 1.56 to 2.51 Mcal of energy per kg of EBW. The ratio of EBW/BW was 0.81. The NE_g requirements to gain ranged from 2.85 to 4.58 Mcal/kg EBW gain and NP_g to gain ranged from 181.36 to 198.78 g/kg EBW gain for the castrated indigenous goat kids weighing between 15 and 25 kg. This study has indicated that castrated Moxotó goat kids have different protein and energy requirements in relation to those values commonly recommended by feeding system for other breeds.

Key Words: body composition, caatinga, comparative slaughter

T505 Reproductive outcomes of anovulatory females exposed to males treated with either i.m. or s.c. testosterone. Andrea González-Tavizón*[1], Cezar A. Meza-Herrera[2], Alan Sebastián Alvarado-Espino[1], Vicente Homero González-Álvarez[1], M. de los Angeles de Santiago-Miramontes[1], M. Guadalupe Calderón-Leyva[1], Juan Manuel Guillen Muñoz[1], Fernando Arrellano-Rodríguez[1], and Francisco Gerardo Véliz-Deras[1], *[1]Universidad Autónoma Agraria Antonio Narro, Torreón Coahuila, México, [2]Universidad Autónoma Chapingo, Unidad Universitaria de Zonas Aridas, Bermejillo Durango, México.*

The aim of this study was to evaluate the reproductive response of anovulatory goats exposed to bucks treated with either intramuscular (i.m.) or subcutaneous (s.c.) testosterone in April in northern Mexico (25°N, 103°W). Anovulatory female goats (n = 60) were divided in 3 homogeneous groups regarding body weight and condition (20 goats each) and exposed to 2 of 6 multiracial bucks. Males were randomly selected to receive different treatments: (1) 50 mg testosterone i.m. (TIM, n = 2), (2) 50 mg testosterone s.c. (TSC, n = 2) and (3) 0.5 mL of physiological saline (CONT, n = 2). Treatments lasted 21 d, with treatments every 3 d. Thereafter, each group of males was exposed to 20 females to evaluate the male effect. Response variables considered the latency (interval between introduction of the males and estrus initiation) and sexual activity of females twice daily (0700 and 1900 h), for 10 d. The percentages of females in heat, ovulated (10-d post-male introduction) and pregnant (45-d post-treatment) were also considered. Ovulation and pregnancy response were evaluated by transrectal ultrasonographic scanning (7.5 MHz, HS-2000, Honda Electronic CO, LTD). The proportions of females showing estrus, ovulation and pregnancy were compared using an exact Fisher probability test, while latency considered the Student *t*-test (SYSTAT 5.03 software). Results suggest that males treated with either SC or IM testosterone depicted similar reproductive outcomes, with the TIM depicting the highest

estrus response ($P < 0.05$) yet without differences regarding ovulation and pregnancy rates (Table 1).

Table 1 (Abstr. T505). Reproductive outcomes in anovulatory goats exposed to the male effect with mix-breed bucks treated either with s.c or i.m. testosterone during the anovulatory season in northern Mexico (May, 25°N)

Groups	Latency	Estrus %	Ovulation %	Gestation %
CONT	50 ± 3.8^a	$65\ (14/20)^a$	$50\ (10/20)^a$	$10\ (2/20)^a$
TIM	38.4 ± 5.4^a	$100\ (20/20)^b$	$65\ (14/20)^a$	$55\ (12/20)^b$
TSC	42 ± 3.9^a	$65\ (14/20)^a$	$47.5\ (9/20)^a$	$45\ (8/20)^b$

Values with different superscripts within column differ ($P < 0.05$).

Key Words: seasonal reproduction, female goat, testosterone

T506 Mineral requirements for growth and maintenance of F_1 Boer × Saanen male kids. Izabelle A. M. A. Teixeira*[1], Carla J. Härter[1], José M. Pereira Filho[2], Américo G. Silva Sobrinho[1], and Kleber T. Resende[1],. *[1]UNESP, Universidade Estadual Paulista, Department of Animal Science, Jaboticabal, SP, Brazil, [2]Universidade Federal De Campina Grande, Patos, PB, Brazil.*

The objective of this study was to determine the net requirements of minerals for the growth and maintenance of intact male F_1 Boer × Saanen goat kids in the initial phase of growth. The following 2 experiments were performed: Exp.1 was performed to determine the net growth requirements of Ca, P, Mg, Na and K of F_1 Boer × Saanen goat kids from 5 to 25 kg of BW; Exp.2 was performed to determine the maintenance requirements for F_1 Boer × Saanen goats from 15 to 25 kg BW. In Exp.1, 32 intact male goat kids were distributed in a completely randomized design and its mineral body composition were fitted by an allometric equation in the form of nonlinear model. To determine the mineral requirements for maintenance of Exp. 2, 21 intact male goat kids were distributed in a randomized-block design, where the goat kids were subjected to 3 levels of feed restriction (0, 30, and 60% feed restriction). At the onset of the Exp.2, 7 goat kids were harvested and used to estimate the initial body composition (15 kg BW). Initial body composition was used to calculate the retention of minerals. The maintenance requirements were estimated by regressions obtained from the retention of minerals in the empty body and the intake of the mineral. The concentration of Ca, P, Na, and K in the empty BW decreased by 11, 13, 26, and 23% with the increase in BW from 5 to 25 kg ($P < 0.01$). As a consequence, our results showed that net requirements of Ca, P, Mg, Na, and K for weight gain decreased by 27.5, 27.8, 4.25, 43.2, and 39.7%, respectively, with the increase in BW from 5 to 25 kg ($P < 0.01$). The net requirements (in g/kg of ADG) decreased from 9.7 to 7.0 for Ca, 6.5 to 4.7 for P, 0.38 to 0.36 for Mg, 0.88 to 0.50 for Na, and 1.9 to 1.2 for K when BW increased from 5 to 25 kg. The daily net requirements for maintenance per kg of BW were 38 mg of Ca, 42 mg of P, 1.6 mg of Mg, 5.0 mg of Na, and 19 mg of K. These results for the nutritional requirements of minerals may help to formulate more balanced diets for F_1 Boer × Saanen goat kids in the initial growth phase.

Key Words: body composition, comparative slaughter, crossbred goat

T507 Analysing the diversity of five Spanish sheep breeds by combining massive genotyping and RNA-seq data. Antonia Noce[1], Arianna Manunza[1], Ángela Cánovas[1], Silvia Adán[2], Luis A. Bermejo[3], Juan Capote[4], Juan Vicente Delgado[5], Jordi Jordana[6], Vincenzo Landi[5], Agueda Pons[7], Armand Sánchez[1], Oriol Vidal[8], Amparo Martínez[5], Marcel Amills[1], Joaquim Casellas*[6], *[1]Centro de Investigación en Agrigenómica, Bellaterra, Spain, [2]Federación de Razas Autóctonas de Galicia, Coles, Spain, [3]Universidad de La Laguna, San Cristóbal de la Laguna, Spain, [4]Instituto Canario de Investigaciones Agrarias, San Cristóbal de la Laguna, Spain, [5]Universidad de Córdoba, Córdoba, Spain, [6]Universitat Autònoma de Barcelona, Bellaterra, Spain, [7]Serveis de Millora Agrària i Pesquera, Son Ferriol, Spain, [8]Universiat de Girona, Girona, Spain.*

The objective of this research was to characterize the genetic diversity in 5 Spanish sheep breeds from high throughput data. We have used the OvineSNP50 Genotyping BeadChip to genotype 54,241 single nucleotide polymorphisms (SNPs) in 5 endangered Spanish ovine breeds (Xisqueta, Ripollesa, Roja Mallorquina, Canaria de Pelo o Pelibuey and Gallega) with the intention of investigating their genetic relationships and population structure. Multidimensional scaling plot and Admixture analyses revealed that the 2 insular breeds, i.e., Canaria de Pelo (Canary Islands) and Roja Mallorquina (Majorca Island), are the 2 most differentiated populations. African influences and prolonged geographic isolation may partly explain these observations. In contrast, the 3 peninsular breeds showed a weak level differentiation (FST = 0.01–0.03). We have also investigated the variability of the 5 Spanish breeds mentioned above through a RNA-seq approach. More specifically, we sequenced muscle mRNA from pools of 10 individuals by using a Hiseq 2000 platform (Illumina). Our main goal was to find out which percentage of the variation of these populations is breed-specific. Around 300 million reads were obtained per breed, and approximately 70% of them were sucessfully mapped to the latest version of the sheep reference genome. The total number of SNPs retrieved per breed ranged from 147,262 SNPs (Gallega) to 368,661 SNPs (Xisqueta). Obviously, genotyping experiments in a broader sample of individuals will be necessary to confirm the population-specificity of these SNPs. As a whole, our data suggest that ovine breeds share a substantial amount of variability, probably due to the combined effects of recent divergence and gene flow. However, we have also obtained evidence that thousands of variants appear to segregate specifically in particular breeds, a finding that reinforces the need of making every effort to conserve these unique genetic resources.

Key Words: genetic diversity, RNA sequencing, sheep breed

T508 Body condition as a reference for slaughter of feedlot lambs fed sunflower cake. Flavio Monção[2], Euclides Oliveira[1], Andréia Gabriel[1], Rodrigo Sousa[1], Jefferson Gandra*[1], Mariana Santos[1], Lais Moura[1], Luiz Henrique Silva[1], Leandro Silva[1], Loan Silva[1], Thais Pereira[1], and Vadim Carbonari[1], *[1]Faculdade de Ciências Agrárias, Universidade Federal da Grande Dourados, Dourados, MS, Brazil, [2]Universidade Estadual Julio de Mesquita, Jaboticabal, SP, Brazil, Jaboticabal, SP, Brazil.*

The aim of this study was to evaluate the qualitative and quantitative carcass traits of lambs fed different levels of sunflower cake. For this experiment 28 lambs, crossbred Suffolk, non-castrated males, with an average weight of 21 kg, aging 4 mo were used. The animals were divided into weight classes (4 treatments) and 7 animals per treatmen in a randomized block design. The lambs stayed in the feedlot for a period 70 d. The study treatments were: T 1 - Treatment control, 0% of sunflower cake (84.56% DM; 17.45% CP; 60.22% NDF; 1,34% Fat; 56.60% TDN); T 2 - Treatment with 10% sunflower cake; T 3 - Treatment with 20% sunflower cake; T 4 - Treatment with 30% of sunflower cake. The roughage: concentrate ratio of 50:50 was used on the dry matter basis (DM). When the lambs from each treatment reached the body condition in the range of (2.5 to 3.5), the animal was slaughtered and determined the following parameters: SW- slaughter weight; HCY - Hot carcass yield; CCY- Cold carcass yield; ICL- Internal carcass length; SFT- Subcutaneous fat thickness; TEX- Texture; MARB- Marbling.

The statistical analyses were performed by the SAEG program. In this trial the correlation analysis of the variables allowed to verify that SW (slaughter weight) of lambs was not significantly correlated with HCY, CCY, ICL, SFT, COLOR, MARB and AEL However, it displayed a negative correlation with TEX (texture) of the meat. The HCY was highly correlated with the CCY, in other words, the greater the HCY lower losses occurred during cooling of the carcass, the better CCY. The CCY also showed a positive correlation with TEX and AEL, ICL also showed a positive correlation with the SFT. It was verified that the color and marbling of the meat showed no significant correlations with the other traits. Therefore, it was expected that animals with higher slaughter weight presented positive correlation with marbling, which did not happen in this study that could be justified by the period of confinement of the animals. About the color and texture, no significant difference was noticed. In conclusion, the sunflower cake can be used in supplements for lambs in intensive production systems in partial substitution of soybean meal up to 20%.

Key Words: body condition, sunflower cake, lamb

T509 Performance of Santa Inês meat lambs receiving cactus pear (*Opuntia ficus indica* Mill) in substitution of forage with or without access of water. José Matias Porto Filho[1], Leonardo S. Knupp[2], Antonello Cannas*[2], Alberto S. Atzori[2], Ariosvaldo N. Medeiros[1], George R. B. Cruz[1], Genilson B. Silva[1], and Roberto G. Costa[1], *[1]Programa de Pós Graduação em Ciência e Tecnologia de Alimentos, Universidade Federal da Paraíba, João Pessoa, Paraíba, Brazil, [2]Dipartimento di Agraria, University of Sassari, Sardinia, Italy.*

This work aimed to study the performance of Santa Inês meat lambs receiving different levels of inclusion of cactus pear (*Opuntia ficus indica* Mill) in substitution of Tifton (*Cynodon dactylon*) hay. The trial was conducted using 48 Santa Inês male lambs at 180 d of age, with average initial weight of 21.64 ± 0.48 kg. Diets were formulated to be isoproteic and isoenergetic. Animals had ad libitum access to feed. The experiment was carried out as a completely randomized factorial design (3 × 2) with 3 levels of substitution of Tifton hay with cactus pear (30%, 50% and 70%) subdivided in 2 groups, with or without access of water and a control treatment. DMI significantly differed among treatments ($P < 0.001$) and the interaction among levels of cactus and access of water were not significant for all variables ($P > 0.05$). The equations to estimate DMI and the ADG in the diets with cactus pear were: DMI = $1776.9 – 26.3x + 96.6y + 0.14x^2 - 2.08xy$ ($R^2 = 0.86$); ADG = $34.4 + 7.9x - 106.5y - 0.09x^2 - 1.74xy$ ($R^2 = 0.57$), being x = level of inclusion of cactus pear in the diet (30, 50, 70%) and y = animals with (1) or without (0) access of water. In contrast, the equations to predict the DMI and the ADG including the control treatment with the group that had access of water were: DMI = $1094.3 + 5.3x - 0.19x^2$ ($R^2 = 0.87$); ADG = $242.3 + 1.77x - 0.047x^2$ ($R^2 = 0.76$), being x = diet control and levels of cactus (0, 30, 50, 70%). The maximum value of DMI was 1.1 kg/day and the minimum was 0.5 kg/day, obtained for the group receiving 30% of cactus with access of water and 70% with access of water, respectively. The ADG was different among treatments ($P < 0.05$) ranging between 245.1 g to 134.4 g for the group with 30% of cactus in the diet with access of water and those that received 70% of cactus with access of water, respectively. Feed efficiency was affected by treatments, being the group that received 50% of cactus in the diet more efficient (0.27 g). In conclusion, cactus pear is recommended at 30% (with access of water) or 50% (without access of water) of substitution of Tifton hay, resulting in ADG of 253 or 205, respectively.

Key Words: cactus, dry matter intake, weight gain

T510 Effects of oral glycerol dosage on short duration transportation shrink in goats. Amy L. Bax*[1], James D. Caldwell[1], Taylor N. Drane[1], Kelsey L. Basinger[2], Haley L. Bartimus[2], Jessica K. Clark[2], Cindy A. DeOrnellis[1], Jeri D. Rippeto[1], Abbey J. Kempker[1], Mikel J. Thompson[1], Blake E. Koelling[1], and Bruce C. Shanks[1], *[1]Lincoln University, Jefferson City, MO, [2]University of Arkansas, Fayetteville, AR.*

The use of various osmolyte products as a means for increasing blood glucose and mediating effects of shrink have been shown to be effective in different livestock species, but have been examined very little in goats. Therefore, the objective was to evaluate the effects of oral glycerol dosage on short duration transportation shrink in goats. On January 19, 2015, a total of 27 (23.4 ± 0.4 kg BW) intact and castrated male goat kids were stratified by sex and BW, and allocated randomly to 1 of 3 treatments: 1) control (C; n = 9); 2) 1 mL oral dose of glycerol per 0.45 kg of BW (n = 9); or 3) 2 mL oral dose of glycerol per 0.45 kg of BW (n = 9). Goats had ad libitum access to mixed-grass pasture and water until initiation of the study. At 0830, goat kids were gathered, bled, weighed, and dosed with glycerol according to treatment. Goats were then transported in a livestock trailer for approximately 4.5 h with an average ambient temperature of 12°C. After transport, goats were unloaded, bled, re-weighed, and returned to their pasture for the night. After a 24-h recovery time, goats were bled and weighed a final time. Data were analyzed using PROC MIXED of SAS with 2 preplanned orthogonal contrast statements: (1) the mean of control vs the mean of 1 mL and 2 mL, and (2) the mean of 1 mL vs 2 mL. Beginning weight, final weight, 24-h recovery weight, shrink, and recovery weight change did not differ ($P \geq 0.31$) across treatments. Beginning white blood cell, final monocyte, basophil, and platelet, and 24-h monocyte counts were higher ($P \leq 0.05$) and beginning neutrophil and eosinophil, and final red blood cell and white blood cell counts and mean corpuscular volumes tended ($P \leq 0.10$) to be higher for 2 mL vs 1 mL. The 24-h neutrophil counts were higher ($P = 0.05$) and 24-h lymphocyte counts and white blood cell counts change tended ($P \leq 0.08$) to be higher for C vs 1 mL and 2 mL. There were no differences ($P \geq 0.13$) in the other blood measurements. Therefore, oral glycerol dosage may affect some blood measurements, but ultimately kid goats in this study did not shrink; thus, the effects of this treatment on short duration transportation shrink in goats were undetermined.

Key Words: glycerol, goat, shrink

T511 Effects of breed and resistance classification of sire on progeny growth performance and response to artificial infection with *Haemonchus contortus* in a central performance test. Yoko Tsukahara*[1], Terry A. Gipson[1], Steven P. Hart[1], Lionel J. Dawson[1,2], Zaisen Wang[1], Ryszard Puchala[1], Tilahun Sahlu[1], and Arthur L. Goetsch[1], *[1]American Institute for Goat Research, Langston University, Langston, OK, [2]Center of Veterinary Health Sciences, Oklahoma State University, Stillwater, OK.*

Fifteen Dorper (D; 3.8 mo of age, 29 kg), 14 St. Croix (C; 3.9 mo, 18 kg), 14 Kiko (K; 4.0 mo, 19 kg), 13 Boer (B; 3.2 mo, 22 kg), and 17 Spanish (S; 3.1 mo, 18 kg) males were used to investigate effects of classification for resistance to *Haemonchus contortus* of sire and among and within breed differences in the second year of a central test at Langston University (LU) for growth performance and response to artificial infection with infective larvae. In the first year of the test, males were randomly selected from 4 commercial farms in KS, MO, and OK and LU B and S goat herds. Animals used in this study were progeny of the sires (i.e., High and Moderate, with no progeny of susceptible males) selected in the first year. For both years, the test entailed an adjustment period of

2 wk followed by 8 wk of data collection. Animal groups were housed separately in adjacent pens with automated feeders allowing free-choice access to a 15% CP (DM) and 50% concentrate pelletized diet. During adaptation, anthelmintic treatment resulted in low fecal egg count (FEC; < 600/g), after which 10,000 larvae were administered orally. Packed cell volume (PCV) was measured weekly and FEC was determined 4 times in wk 6–8. For analysis, initial BW, PCV, and FEC were covariates, and the logarithmic transformation ln(x + 2,000) was used for mean FEC. Breed affected ($P \leq 0.01$) ADG (307, 286, 159, 247, and 142 g; SEM = 13.8), DMI (2.2, 1.6, 1.3, 1.5, and 1.3 kg; SEM = 0.12), FEC (2,098, 1,278, 1,419, 1,335, and 716 eggs/g, original scale; SEM = 80.9), and PCV (27.2, 31.7, 31.6, 28.1, and 25.6% ; SEM = 0.76 for D, C, K, B, and S, respectively). Means of resistance classification of sires were similar ($P > 0.10$) for FEC, PCV, ADG, and DMI. Correlation coefficients of sire and progeny FEC within breed were nonsignificant ($P > 0.10$). In conclusion, with only one generation of selection, there was no detectable relationship in resistance to internal parasite between selected sires and progeny based on FEC after an artificial challenge with *H. contortus* larvae in a standardized environment.

Key Words: goat, internal parasitism, sheep

T512 Growth performance and resistance to internal parasitism of small ruminant males from the south-central US in a centralized test. Yoko Tsukahara*[1], Terry A. Gipson[1], Steven P. Hart[1], Lionel J. Dawson[1,2], Zaisen Wang[1], Ryszard Puchala[1], Tilahun Sahlu[1], and Arthur L. Goetsch[1], *[1]American Institute for Goat Research, Langston University, Langston, OK, [2]Center of Veterinary Health Sciences, Oklahoma State University, Stillwater, OK.*

Various breeds of young male sheep and goats from commercial farms in Arkansas, Kansas, Missouri, and Oklahoma and of Langston University (LU) were used in a centralized test at LU, which included artificial infection with *Haemonchus contortus*, to investigate growth performance and genetic resistance to internal parasitism. Year 1 included 2 Katahdin flocks (KS-A, n = 17, 3.5 mo of age, 35 kg; KS-B, 18, 4.0 mo, 19 kg), 20 Dorper (DS; 8.2 mo, 45 kg), 13 St. Croix (CS; 4.4 mo, 21 kg), 2 Boer herds (BG-A; 16, 3.8 mo, 21 kg; BG-B, 17, 19 kg) 16 Kiko (KG; 3.1 mo, 20 kg), and 14 Spanish (SG; 4.4 mo, 19 kg). In year 2, animals were progeny from breeding groups classified in year 1 as of high and moderate resistance, with 15 DS (3.8 mo, 29 kg), 14 CS (3.9 mo, 18 kg), 14 KG (4.0 mo, 19 kg), 13 BG-A (3.2 mo, 22 kg), and 17 SG (3.1 mo, 18 kg). There was 2 wk for adaptation and an 8-wk test period, with automated feeders allowing free-choice access to a 50% concentrate pelletized diet. During adaptation, anthelmintic treatment resulted in low fecal egg count (FEC; < 600/g), after which 10,000 infective larvae were administrated orally. Packed cell volume (PCV) was measured weekly and FEC was determined 4 times in wk 6 to 8. Breed affected ($P \leq 0.01$) FEC in year 1 (1,512, 2,196, 3,072, 1,229, 1,069 2,713, 3,575, and 1,182 eggs/g for KS-A, KS-B, DS, CS, BG-A, BG-B, KG, and SG, respectively; SE = 100.0) and year 2 (2,621, 1,368, 1,413, 1,669, and 884 eggs/g for DS, CS, BG-A, KG, and SG, respectively; SEM = 48.1). Animals were placed in 3 categories of resistance (i.e., high, moderate, low) within flocks/herds based primarily on FEC but also considering residual feed intake and ADG using cubic clustering criterion. Resistance category means were similar ($P > 0.05$) for ADG and ADG:DMI in both years. In conclusion, based on FEC after an artificial challenge with *H. contortus* larvae in a standardized environment, there was considerable variability among flocks/herds of small ruminants in resistance to internal parasitism due to multiple factors such as species, breed, and genetic differences within breed.

Key Words: goat, internal parasitism, sheep

T513 The *FecG*^{E} allele of the ovine *GDF9* gene in the Pelibuey breed in México and its effects on prolificacy. Felipe A. Rodríguez-Almeida*, Claudia P. Pérez-Camacho, María E. Burrola-Barraza, and Joel Domínguez-Viveros, *Facultad de Zootecnia y Ecología, Universidad Autónoma de Chihuahua, Chihuahua, México.*

The *FecG*^{E} allele of the ovine *GDF9* gene, reported previously in the Santa Inés breed in Brazil, is segregating in Pelibuey, another hair type sheep breed in México. To determine allelic and genotypic frequencies, as well as effects on prolificacy and potential for marker assisted selection, 160 Pelibuey ewes from 4 flocks in different regions of México [Jalisco 1 (n = 34), Jalisco 2 (n = 62), Tabasco (n = 30) and Chihuahua (n = 34)] were genotyped by RT-PCR (StepOnePlus) using the FAMACTTCAAACAGTTTCTTTTTMGBNFQ and VICTCAAACAGTGTCTTTTTMGBNFQ probes (Applied Biosystems). Pearson's Ji-squared was used to test genotypic frequencies for Hardy-Weinberg equilibrium. After discarding data of lambings that resulted from synchronized estrous with hormones, 631 records of the Poisson variable prolificacy were analyzed using a generalized linear model with PROC GLIMMIX of SAS (SAS Institute Inc., Cary, NC.). The model included fixed effects of year, season, flock, genotype, 2-way interactions and age as a covariate, as well as the random effect of ewe within flock and genotype. The average frequency of the *FecG*^{E} allele was 0.48 (0.48 to 0.54 for the flocks in Jalisco and Chihuahua, and 0.35 for the flock in Tabasco, which is in most challenging environment). Genotypic frequencies were as expected under Hardy-Weinberg equilibrium ($P > 0.10$). Back transformed estimated means for litter size for ewes of the different genotypes were 1.43 for +/+, 1.73 for +/E, and 1.78 for E/E ($P < 0.05$). For genotypes +/+, +/E, and E/E, frequencies of litters with more than 2 lambs were 0.5, 11.4, and 15.2%, respectively; frequencies of litters with a single lamb were 56.0, 37.6, and 35.6%, respectively. Homozygous E/E ewes reproduced normally, in agreement with results from Brazil, but in contrast to the sterility of homozygous ewes reported for other *GDF9* mutations in European breeds. Potential for marker assisted selection exists, especially to produce homozygous rams to be used in low-prolificacy commercial flocks and(or) in crossbreeding with low-prolificacy well-adapted maternal breeds under harsh environments to obtain F_1 ewes.

Key Words: fecundity gene, hair sheep, litter size

T514 Methane concentration and degradation profile of broom sorghum based-diets for sheep. M. A. Cerrillo-Soto[1], A. L. Abdalla[2], R. C. Lucas[2], A. Estrada-Angulo[3], F. G. Rios-Rincón[3], and M. Guerrero-Cervantes*[1], *[1]Universidad Juárez del Estado de Durango, Durango, Dgo, México, [2]Centro de Energia Nuclear na Agricultura, Piracicaba, Sâo Paulo, Brasil, [3]Universidad Autónoma de Sinaloa, Culiacán, Sin., México.*

Broom sorghum (BS) represents a suitable alternative in sheep nutrition practices in Northwest Mexico. Moreover, concerns on rumen methane production support the search for feeds to minimize environmental impacts. This in vitro assay evaluated rumen methanogenesis and degradability characteristics of mixed sheep diets with increasing levels (0, 20, 40, 60 and 80%) of broom sorghum substituting sorghum grain. Diets included soybean meal, Sudan and molasses as well. A semi-automated system for gas production (GP) using a pressure transducer was used. Ground samples (500 mg DM) were weighed into filter bags and further placed into 160-mL glass bottles. A mixture of incubation medium- rumen inoculum was added to the bottles and sealed. Nine Santa Inês cannulated sheep fed tropical grass were used as donors. Head space gas pressure was measured at 4, 8, 12 and 24 h. The CH_4 concentration was determined using gas chromatography. The truly

degraded organic matter (TDOM) was estimated after 24 h incubation by refluxing the filter bags with NDF solution. The partitioning factor was calculated as the ratio of TDOM (mg) and gas volume (mL). Data were analyzed using ANOVA (GLM, SAS). Values for CP, NDF and ADF of the diets varied ($P < 0.05$) from 11 to 13%, 54 to 66% and 16 to 39%, respectively. Gas production (GP) varied among treatments ($P < 0.05$). Increasing levels of BS promoted a reduction in GP from 171 mL/g DM in the 0% (control) to 125 mL/g DM in the 80% treatment. Methane production calculated per unit of TDOM varied from 9.4 to 7.5 mL/g TDOM, although no differences were detected ($P > 0.05$). Nonetheless, methane production calculated per unit of degraded NDF resulted in significant variations ($P < 0.05$). Treatment containing no broom sorghum (0%) resulted in the highest methane production (4.7 mL/g DNDF), whereas 60% treatment showed the lowest (1.9 mL/g DNDF). No differences were detected in TDOM among treatments (mean = 351 g/kg DDM). Similarly, no effect was found in the partitioning factor (mean = 1.24). Results suggested that increasing levels of BS did not affect OM digestibility, although that might promote a reduction in methane concentration. However, further studies are to be performed to elucidate stronger effects.

Key Words: sheep, methane concentration, broom sorghum

T515 Effect of timing of $PGF_{2\alpha}$ administration in a short-term progesterone-based estrous synchronization protocol on fertility in ewes. Callayn D. Paul*, Erin N. Greenleaf, Adam K. Redhead, Abiodun E. Adebiyi, and Marlon Knights, *West Virginia University, Morgantown, WV.*

Traditionally, prostaglandin F2α ($PGF_{2\alpha}$) has been included in short-term progesterone-based estrous synchronization (STPBES) protocols but its inclusion has been associated with a reduction in fertility at the synchronized estrus. To determine if there is an effect of timing of prostaglandin administration relative to the progesterone pre-treatment on fertility, ewes (n = 442) on 4 farms located in WV and PA were randomly assigned to receive controlled internal drug-releasing devices (CIDR-g, 0.3 g progesterone) for 5 d alone (n = 123; treatment 4), in combination with $PGF_{2\alpha}$ (5 mL Lutalyse; 25 mg Dinoprost) at CIDR insertion (n = 103; treatment 1) or removal (n = 100; treatment 2), or 25 mg $PGF_{2\alpha}$ alone (n = 116; treatment 3) before being joined with sexually mature rams. Data were analyzed using ANOVA with the model consisting of the main effects of treatments, farms and their interactions and additionally, least squares means for treatment effects were determined. Ewes receiving only $PGF_{2\alpha}$ had a lower estrous response than other treatments (58.7 ± 3.7% vs. 74.6 ± 37.6%; $P < 0.0001$) but tended to have a higher conception rate than ewes receiving combination treatments of PGF at insertion (78.8 ± 8.9% vs. 61.2 ± 4.9%; $P = 0.08$) or removal (78.8 ± 8.9% vs. 59.8 ± 5.0%; $P = 0.06$). $PGF_{2\alpha}$ ewes also had a significantly lower pregnancy rate to 1st service than ewes receiving the combination treatment with $PGF_{2\alpha}$ at insertion (41.6 ± 4.4% vs. 54.1 ± 4.5%; $P < 0.05$) and ewes receiving CIDR only (41.6 ± 4.4% vs. 58.5 ± 4.1%; $P < 0.005$). There were no effects of treatment on any other measures of reproductive performance. In conclusion, inclusion of $PGF_{2\alpha}$ at the beginning or end of progesterone pretreatment did not enhance synchrony of estrus or other reproductive outcomes. Furthermore, synchronization of estrus with a 5 d treatment of progesterone was sufficient to synchronize estrus with high fertility in ewes.

Key Words: progesterone, prostaglandin, fertility

T516 Method of zilpaterol hydrochloride supplementation on meat quality of feedlot lambs. Horacio Davila-Ramos*, Karla Hildeliza Leyva-Medina, Salvador Garcia-Sandoval, Jessica Berenice Zuñiga-Villegas, and Juan Carlos Robles-Estrada, *Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico.*

Zilpaterol hydrochloride (ZH) is a β-adrenergic agonist was approved in México (2002) and the United States (2006) to promote growth and carcass dressing in beef cattle. Forty Dorper × Katahdin (45.4 ± 4.5 kg) crossbred male lambs were used in a 27-d feeding trial (5 pens/treatment) to evaluate the influence of method of zilpaterol supplementation on growth performance and carcass characteristics. Lambs were fed twice daily with a cracked corn based (64%) experimental diet (1.39 Mcal/kg of NE_g and 14.0% CP). The animals were allotted to individual pens (6 m^2) with full shade and ad libitum water. Treatments were (1) control (CON), no zilpaterol supplementation; (2) total dose of zilpaterol was offered only in morning feeding (AM), (3) total dose of zilpaterol was offered in morning and afternoon feeding (PPM), and (4) total dose of zilpaterol consisted in offering one day and suspended the next day, like intermittent supplementation (INT). Zilpaterol was supplemented at a rate of 0.20 mg/kg of live weight d^{-1} (as zilpaterol chlorhydrate, Zilmax). The lambs were slaughtered in a local slaughterhouse. The data were analized at complete randomized design, with orthogonal contrast and means compare with LSD. Zilpaterol supplementation (CON vs AM, PPM) decreased the redness index (a^*) (10.9%; $P < 0.04$), yellowness index (b^*) (15.5%; $P < 0.03$) and chromaticity (13.6%; $P < 0.02$). Shear force values of zilpaterol supplementation tended to be greater ($P = 0.08$) than shear force values of CON. There were not differences on pH values between treatments. Zilpaterol intermittent supplementation (CON vs INT) reduced luminosity (L^*) (10.3%; $P = 0.05$), no statistical difference was found with the remaining variables ($P \geq 0.12$), similarly, the contrast (INT vs. AM) showed no significant differences ($P \geq 0.33$) in all variables evaluated.

Key Words: zilpaterol supplementation, lamb, meat quality

T517 Effect of weaning on rapid rebreeding in Katahdin ewes. Erin N. Greenleaf*, Callayn D. Paul, Abiodun E. Adebiyi, Kyle J. Powell, Adam K. Redhead, and Marlon Knights, *West Virginia University, Morgantown, WV.*

To increase the frequency of lambing, ewes must be mated during seasonal anestrus and while lactating. The present study investigated the effect of lactation and season on the fertility of Katahdin ewes rebred while lactating. Fall-lambing ewes (n = 57, 2 mo postpartum, experiment 1) and spring-lambing ewes (n = 40, 3 mo postpartun, experiment 2) were randomly assigned within birth type to be weaned approximately 3 weeks before breeding or to continue to suckle their lambs for an additional 3 mo. In experiment 1, all ewes were treated with a controlled internal drug releasing (CIDR-g; 0.3 g progesterone) device for 5 d and introduced to rams. In experiment 2, half of the ewes in each lactation status group were treated with an estrus induction protocol consisting of a pre-treatment with a CIDR device for 5 d and an injection with 3 mL P.G. 600 (240IU eCG and 120 IU hCG) at insert removal or received no further treatment. In experiment 1, the mean estrous response, conception rate, pregnancy rate to the first and second service period, proportion of ewes lambing and prolificacy was 64.9, 89.2, 57.9, 91.2, 67.3 and 129% respectively and was not affected by lactation status. In experiment 2, estrous response tended to be higher in suckling compared with weaned ewes (50 vs 11.1%, $P = 0.08$) but lactation status did not affect any of the other variables measured. Ewes receiving the estrous induction protocol had a higher ($P < 0.01$) estrous response, conception rate, pregnancy rate to the first and second service period, proportion of ewe lambing to the first service period and overall and lambing rate (84.2 vs 33.3%; 81.3 vs 0; 80 vs 0; 94 vs 23.8; 61.1 vs 0; 72.2 vs 30 and

111.1 vs 40%, respectively). Lambs suckling their dams gained more weight and grew faster (19.6 vs 14.1 kg; 13.1 ± 0.68 vs 11.3 ± 0.85 kg and 183 ± 0.6 vs 131 ± 0.6 g/d; 128.2 ± 0.7 vs 110.4 ± 0.8 g/d, ($P <$ 0.001 and $P < 0.1$ for experiments 1 and 2, respectively). In conclusion, weaning depressed growth of lambs and did not improve the ability of Katahdin ewes to rebreed in the postpartum period. However, treatment with an estrous induction protocol is necessary for early rebreeding of Katahdin ewes during seasonal anestrus.

Key Words: Katahdin, postpartum period, estrous

T518 Effect of supplementation with propylene glycol and lactation period on energy metabolism of lactating ewes. Simone Pedro da Silva*[1], Gilberto de Lima Macedo Junior[2], Rogério Pereira dos Santos[3], Jhone Talisson Lira de Sousa[3], Marina Elizabeth Barbosa de Andrade[4], Érica Beatriz Schultz[2], Luciano Fernandes de Sousa[3], Adriano Santana Crozara[2], and Nhayandra Christina Dias e Silva[4], *[1]Instituto Federal Goiano, Hidrolândia, Goias, Brazil, [2]Universidade Federal de Uberlândia, Uberlândia, Minas Gerais, Brazil, [3]Universidade Federal do Tocantins, Araguaína, Tocantins, Brazil, [4]Universidade Estadual Paulista, Jaboticabal, São Paulo, Brazil.*

The objective of this study was to evaluate the effect of supplementation with propylene glycol (PG) in water and the lactation period on energy metabolism of 19 lactating ewes Santa Ines with initial body weight (BW) 58.67 ± 0.80 kg, from calving to weaning (0–90 d), organized into 4 treatments (0.0, 1.5, 3.0 and 4.5% PG) in a completely randomized in a split plot design. The experiment was conducted at sheep sector in Federal University of Uberlândia, Minas Gerais, Brazil. The animals were fed a total mixed ration consisting relation roughage concentrate 67:32. Blood samples were collected every 7 d, totaling 12 blood collections. In these samples we evaluated triglycerides, cholesterol, very low density lipoprotein (VLDL), high density lipoprotein (HDL), low density lipoprotein (LDL), LDL/HDL, β-hydroxybutyrate and enzyme gamma glutamyl transferase (GGT). The supplementation with propylene glycol not affected the levels serum of triglycerides, VLDL, LDL, and LDL/HDL in the blood ($P > 0.05$). The triglycerides and VLDL levels in the blood showed a linear decrease with the advancing lactation ($P <$ 0.01). The cholesterol and HDL levels in the blood showed quadratic response with maximum cholesterol concentration at 61, 70, 68 e 53 d of lactation and maximum HDL concentration at 58, 86, 58 e 85 d of lactation according with supplementation of 0.0, 1.5, 3.0 and 4.5% propylene glycol, respectively. The β-hydroxybutyrate level showed a linear decrease with the increase of propylene glycol ($P < 0.05$). There was no effect of lactation period on the levels serum β hydroxybutyrate on the blood ($P > 0.05$). The level of enzyme gamma glutamyl transferase (GGT) in the blood was not affected by the inclusion of propylene glycol ($P > 0.05$), but was affected by lactation period ($P < 0.01$). With 36 d of lactation, sheep showed the maximum concentration of GGT (80.36 IU/L). Supplementation with propylene glycol improved the energy status of the sheep and, thus, caused a reduction in the levels of ketone bodies. We concluded that supplementation with propylene glycol reduces the adverse effects of negative energetic balance in sheep during the lactation.

Key Words: energetic balance, metabolic profile

T519 Crude glycerin added into low-starch diets improved fatty acid profile of lamb meat. V. B. Carvalho*, J. M. B. Ezequiel, R. F. Leite, M. T. C. Almeida, J. R. Paschoaloto, H. L. Perez, E. A. Oliveira, A. C. Homem Junior, E. B. Carvalho, and E. S. Castro Filho, *Universidade Estadual Paulista, Jaboticabal, São Paulo, Brazil.*

The objective was to evaluate replacement of corn with crude glycerin (CG) in high-concentrate, low starch diets on fatty acid profile of meat. Forty Santa Ines lambs (23.5 ± 1.35 kg BW) were assigned to a randomized block design with 5 treatments: 0, 7.5, 15, 22.5, and 30% of CG (DM basis). The diet with 30% of CG promoted total replacement of corn. The diets consisted of Tifton-85 hay, corn, CG (83% glycerol), corn gluten meal, corn oil, urea, sunflower meal, soybean hulls and mineral. All diets had around 18% roughage and 82% concentrate. The animals were housed in individual pens and fed ad libitum twice daily at 0700 and 1600 h. The experimental period had 72 ± 7 d of duration and animal harvest was performed when the animals had reached 38 kg BW. Orthogonal contrasts were used to determine the linear and quadratic effects of CG and also constrast of 0% CG vs. CG treatments was used. Odd-chain fatty acids (C15:0, C17:0 and C17:1), oleic (C18:1), palmitoleic (C16:1), total monounsaturated, total unsaturated fatty acids, and their ratios to saturated fatty acids increased linearly within increasing CG. The concentration of all these fatty acids and the ratios, except C16:1, were greater in animals fed any concentration of CG compared with animals fed without CG ($P < 0.01$). The CLA tended to increase in glycerin-fed lambs ($P = 0.06$). The CG decreased linearly the stearic (C18:0), palmitic (C16:0), transvaccenic (C18:1 t11) and total saturated fatty acids ($P < 0.01$). The myristic acid (C14:0) tended to decrease quadratically with increasing CG ($P = 0.06$). The concentration of C18:0, C16:0, C14:0 and total saturated fatty acids decreased when CG was added, regardless of concentration ($P \leq 0.02$). The C18:1 t11 tended to be present in greater concentrations in animals fed without CG compared with animals fed CG ($P = 0.09$). Crude glycerin can be a viable alternative as an energy source in the diet of lambs fully replacing corn into low-starch diets, providing meat with healthier fatty acid profile.

Key Words: corn, glycerol, high-concentrate

T520 Detection of gene expression and location of receptors activated by the oral administration of lithium chloride for conditioned taste aversion in sheep. Katariina Vara[1], Ahmed K. K. Salama[1,2], Carmen L. Manuelian[1], Maristela Rovai*[1], Juan J. Loor[3], Elena Albanell[1], Xavier Such[1], and Gerardo Caja[1], *[1]Group of Ruminant Research (G2R), Universitat Autònoma de Barcelona, Bellaterra, Spain, [2]Animal Production Research Institute, Dokki, Giza, Egypt, [3]Department Animal Science. University of Illinois, Urbana, IL.*

The emetic system activation (nausea and vomiting) plays a key role in the negative postingestive feedback. Lithium chloride (LiCl) is a nonlethal gastrointestinal drug that stimulates the chemoreceptor trigger zone, activating the emetic center and generating conditioned taste aversion (CTA) without other side-effects. There is scarce information on the pathways involved in the CTA mechanism by using LiCl. The aim of this study was to determine changes in gene expression of 4 genes (*CNR1*, *GCG*, *GLP1R*, *HTR3A*) involved in food intake and nausea. A total of 9 Manchega dry ewes, orally dosed with 225 mg LiCl/kg BW, were allocated into 3 euthanasia groups (0, 12 and 24 h after LiCl administration). Brain (area postrema), distal small intestine and colon tissue samples were collected, snap-frozen in liquid nitrogen, and stored at −80°C until analysis. The total RNA was extracted and purified using miRNeasy Mini Kit, and concentration and integrity determined by NonoDrop ND-1000 Spectrophotometer and Agilent 2100 Bioanalyzer, respectively. Gene expressions were determined by RT-qPCR with designed primers and 3 internal control genes. Data were normalized using the geometric mean of internal control genes,

and expression values calculated using base-10 logarithm. As results, expressions of CNR1 and GLP1R were detected in all 3 tissues, and GCG was only detected in the distal small intestine and colon. The overall expressions of CNR1 and GLP1R differed by time and tissue, whereas GCG differed by time points. The CNR1 expression showed a linear regression in distal small intestine (decrease) and colon (increase) when comparing expression levels before and after Li administration. The GCG expression increased in distal small intestine and GLP1 expression decreased in colon 24 h after euthanasia. In conclusion, LiCl administration for a CTA treatment revealed changes in the expression of the genes *CNR1*, *GCG* and *GLP1R* in brain, distal small intestine and colon. Acknowledgments: Spanish Plan Nacional I+D+I (Project AGL2010–22178-CO2–01).

Key Words: *CNR1*, *GCG*, food aversion

T521 Conditioned taste aversion generalization by aroma in sheep. Carmen L. Manuelian[1], Elena Albanell[1], Maristela Rovai*[1], Ahmed K. K. Salama[1,2], and Gerardo Caja[1], *[1]Group of Ruminant Research (G2R), Universitat Autònoma de Barcelona, Bellaterra, Barcelona, Spain, [2]Animal Production Research Institute, Dokki, Giza, Egypt.*

Neophobia is an innate protective mechanism that allows animals to learn from postingestive consequences of eating a new and potentially toxic feed before being harmed by it. Small ruminants usually begin to eat an edible feed that they have not previously encountered by ingesting small amounts; thereafter, if there is no negative feedback, they will gradually increase the intake. On the other hand, if there is a negative feedback, they will associated feed characteristics (taste, odor, texture and sight) with the gastrointestinal discomfort and develop rejection for that feed (food aversion, AV). Despite odor, taste and flavor have been used to increase feed intake; however, few studies have examined its effect in AV. The AV occurs to both the taste and odor of a food (flavor); however, if odor is conditioned in compound with taste, potentiation of the odor will occur. Therefore, when the odor is tested by itself, it becomes a highly potent cue for AV. The aim of this study was to evaluate the ability of 2 breeds of sheep (Manchega, n = 10; Lacaune, n = 10) to generalize the induced AV against a concentrate with strawberry odor to barley and grass flavored with the same aroma. The odor was selected after a preliminary test of acceptability between chocolate and strawberry odors with no taste cues. Ewes were allocated into 2 groups/breed and treatment consisted in: Control (C, water) and Aversion (AV, 225 mg LiCl/kg BW). For AV induction, 100 g of concentrated with strawberry odor was offered individually during 5 min and thereafter orally administered the treatment (water or LiCl). The AV induction lasted 3 d, and redosing when necessary (intake > 75 g). On d 6, 100 g of concentrated, barley and grass with strawberry odor were offered individually during 5 min each food. The 80% of the animals needed ≥ 2 LiCl doses to establish the AV. No differences between breeds were observed in the AV behavior. Generalization of the AV toward barley and grass with strawberry odor was not observed. In conclusion, the use of a flavor instead of an odor could be more effective in the AV generalization. Acknowledgments: Spanish Plan Nacional I+D+I (Project AGL2010–22178-CO2–01) and Lucta (Montornés del Valles, Spain).

Key Words: lithium chloride, flavor, neophobia.

T522 Microbial population and in vitro gas production of sheep fed diets with starch and neutral detergent-soluble fiber. Josemir S. Gonçalves*[1], Jane M. B. Ezequiel[1], Eric H. C. B. Van Cleef[1], Antonio C. Homem Junior[2], and Raquel L. Salgado[3], *[1]UNESP - Univ Estadual Paulista, Faculdade de Ciências Agrárias e Veterinárias, Jaboticabal, São Paulo, Brazil, [2]UNESP - Univ Estadual Paulista, Faculdade de Engenharia, Ilha Solteira, São Paulo, Brazil, [3]UFERSA - Federal University of Semi-arid, Mossoró, Rio Grande do Norte, Brazil.*

Six ruminally cannulated male sheep (Santa Ines × Dorper; 35 ± 0.9 kg BW) were used to evaluate the effects of diets containing different levels of starch and neutral detergent-soluble fiber on protozoa and bacterial fractions, as well as methane and carbonic gases productions. Lambs were assigned to a replicated 3 × 3 Latin square design. Each experimental period consisted of 20 d adaptation and 1 d sampling. Diets consisted of 30% corn silage and 70% concentrate (corn grain, citrus pulp, sunflower meal, soybean hulls, sunflower oil, urea and minerals), providing one diet with high starch content (26.7%), one with same content of starch and neutral detergent-soluble fiber (18.4%) and one with high neutral detergent-soluble fiber (24.3%). Ruminal content were sampled on d 21of each experimental period, at 1.5; 6.5 and 11.5 h after the morning feeding. Samples were strained through a nylon filter to separate liquid and solid phases. Liquid-associated protozoa (LAP) and bacteria (LAB) were obtained using series of filtrations, dilution with salt solution and centrifugations. Particle-associated bacteria (PAB) were obtained using agitation with a salt solution, as well as filtrations and centrifugations. Data were analyzed using the MIXED procedure of SAS, with repeated measures. In vitro fermentation was performed using 250-mL flasks in a completely randomized design with 3 treatments and 6 replicates to evaluate the methane and carbonic gasses production. Samples of diets were added at 1.25 g DM/flask, and consisted of same diets fed to ruminal fluid donor. Data were analyzed using the GLM procedure of SAS. There were no effect ($P > 0.05$) of diets on LAP (980.4 mg/kg DM), LAB (858.9 mg/kg DM) or PAB (1237.7 mg/kg DM). The methane production was unaffected by diets (7.1 L/kg DM; $P > 0.05$) but the high-starch diet decreased carbonic gas production ($P < 0.05$). The starch or neutral detergent-soluble fiber diets do not affect ruminal microbial populations nor methane production.

Key Words: bacteria, fermentation, methane

T523 Effects of replacement of soybean meal with handmade fish meal on productive performance of Pelibuey ewes and their suckling kids. Jose L. Loya-Olguin*[1], Yissel S. Valdes-Garcia[1], Lilia E. Nuñez-Gonzalez[1], Alberto Barreras[2], Alejandro Plascencia[2], Francisco Escalera-Valente[1], and Alejandro A. Gomez-Danes[1], *[1]Posgrado en Ciencias Biológico Agropecuarias/Unidad Académica de Medicina Veterinaria y Zootecnia de Universidad Autónoma de Nayarit, Tepic, Nayarit, Mexico, [2]Instituto de Investigaciones en Ciencias Veterinarias, Universidad Autónoma de Baja California, Mexicali, Baja California, Mexico.*

Thirteen Pelibuey ewes (38 ± 7 kg) were used to evaluate the effect of replacing soybean meal (SBM) with a handmade product of fish (HMF). The experimental period lasted 6 weeks which comprised the last 3 weeks of gestation, where the change of body weight in pregnancy was individually evaluated, and the first 3 weeks of lactation, where changes in body weight, feed intake and milk production and composition were evaluated in sheep, and changes in body weight was evaluated on 22 of their kids (initial wt = 2.52. ± 0.05 kg). Control diet and the test diet used in both phases were formulated to be isonitrogenous and isocaloric. The level of inclusion of SBM and HFM in diets was 7 and 3.5%, respectively. HFM was elaborated with marine fish by-products (whole fish, heads, tails, and backbone). The chemical composition of HMF averaged: 50.8 ± 7.7% CP, fat 9.4 ± 0.8 and 22.7 ± 5.9% ash. There were no differences on DM intake, BW changes and milk production;

however, as a result of an increase (<0.01) in the percentage of protein in milk with HFM treatment, was obtained greater final weight (19%, $P < 0.01$) of their suckling kids. It was concluded that HFM is a suitable substitute of SBM in gestating and lactating ewes. Replacing of SBM with HFM did not altered DM intake and milk performance in ewes. However, changes in the concentration of protein in milk in ewes that received HFM may be reflected in a greater weight gain of lambs in the first 21 d of age.

Key Words: lactating ewes, soybean meal, fish

T524 Ruminal kinetics on sheep fed diets with starch and neutral detergent-soluble fiber. Josemir S. Gonçalves*[1], Jane M. B. Ezequiel[1], Eric H. C. B. Van Cleef[1], Antonio C. Homem Junior[2], and Raquel L. Salgado[3], *[1]UNESP - Univ Estadual Paulista, Faculdade de Ciências Agrárias e Veterinárias, Jaboticabal, São Paulo, Brazil, [2]UNESP-Univ Estadual Paulista, Faculdade de Engenharia, Ilha Solteira, São Paulo, Brazil, [3]UFERSA-Federal University of Semi-arid, Mossoró, Rio Grande do Norte, Brazil.*

The objective of this study was to evaluate the effects of different soluble carbohydrates (starch and neutral detergent-soluble fiber - NDSF) types and proportions on ruminal degradability and fermentation parameters in crossbred sheep. Six ruminally cannulated male sheep (Santa Ines × Dorper; 35 ± 0.9 kg BW) were housed in metabolism cages, assigned to a replicated 3 × 3 Latin square design. During 63 d, lambs were fed with 3 isonitrogenous and isoenergetic diets (30% corn silage and 70% concentrate): D1 - high starch concentration (26.6%) and low NDSF concentrations (13.4%); D2 - similar concentrations (18.4%) of starch and NDSF, D3 - high NDSF concentration (24.3%) and low starch concentration (8.3%). To formulate concentrates were used corn, citrus pulp (only orange), soybean hulls, soybean meal, sunflower meal, sunflower oil and urea. The dried ground samples were incubated in nylon bags (7 × 14 cm) into the rumen for 3, 6, 12, 24, 48 and 72 h. The fraction "a" was determined by washing the bags in water and the residue after 72 h incubation was considered the fraction "c." The potential and effective degradabilities were calculated with the models: $P = a + b (1 - e^{kt})$, and $P = a + b * [k / (k + K_p)]$, respectively. Ammonia nitrogen (AN), volatile fatty acids (VFA), and pH were determined at 1 h pre-prandial and 0, 1, 2, 4, 6, and 8 h after morning feeding. Data were analyzed using the MIXED procedure of SAS, with repeated measures. The degradation parameters were not affected by diets ($P > 0.05$). The corn OM presented potential degradability of 81.7% and degradation rate of 10.7%/h, while citrus pulp OM showed 90.5% and 8.4%/h, respectively. Total VFA, acetic, propionic and butyric acids were unaffected ($P > 0.05$) by dietary treatments (79.3, 50.9, 18.8, and 9.6 mM, respectively). The diets did not alter ruminal pH values (averaging 6.3; $P > 0.05$), but AN concentrations (15.87%) were higher ($P < 0.05$) in D3. Diets with different types and proportions of soluble carbohydrates do not affect neither ruminal degradation kinetics nor VFA concentrations, however the ruminal AN concentration increases in NDSF diets.

Key Words: fermentation, rumen, soluble carbohydrate

T525 Relationship between body condition score and body fat depots in Pelibuey ewes. Gamaliel Antonio-Molina[1], Alfonso Chay-Canul*[1], Juan Ku-Vera[2], Armando Gomez-Vazquez[1], and Aldenamar Cruz-Hernandez[1], *[1]División Académica de Ciencias Agropecuarias, Universidad Juárez Autónoma de Tabasco, Tabsco, Mexico, [2]Facultad de Medicina Veterinaria y Zootecnia, Universidad Autónoma de Yucatán, Yucatán, Mexico.*

Twenty-eight nonlactating and non-pregnant adult Pelibuey ewes, ranging in body condition score (BCS) from 1 (thin) to 5 (obese) were used to study the relationship between body condition score and body fat depots. The animals were humanely slaughtered following the Mexican Official Norms; before slaughter, shrunk BW and BCS were measure after feed and water deprivation for 24 h. The BCS was evaluated using palpation by 2 trained evaluators. Data recorded at slaughter were weights of viscera and carcass. Internal fat (IF, internal adipose tissue) was dissected, weighed and grouped as mesenteric (MF), omental (OF) and kidney knob and channel fat (KKCF). Carcass was then split at the dorsal midline in 2 equal halves, weighed, and chilled at 1°C during 24 h. After refrigeration, the left half of the carcass was completely dissected into subcutaneous and intermuscular fat (carcass fat, CF), muscle, bone and each component weighed separately. Dissected tissues of the left carcass were adjusted as whole carcass. The relationships between BCS and with body fat depots were investigated using regression analysis, with PROC REG of SAS. The BW and BCS at slaughter were highly correlated (r = 0.92). The regression equation for estimating BW from BCS was BW (kg) = 23.46 (±1.62)+ 6.34 (±0.54) × BCS (r^2: 0.84; RSD: 3.41; P: < 0.0001 and n = 28). All equations for relationship between BCS and body fat depots were significant (<0.0001) and the r^2 ranged from 0.87 for CF (RSD = 1.016 kg) to 0.96 for IF (RSD = 1.206). Because the intercept of equations that involved BCS and IF, OF, MF and KKCF were no significant, we fitted a linear regression trough the origin. The regression equation for estimating total body fat (TBF) from BCS were TBF (kg) = −2.64 (±0.911)+ 4.29 (±0.302) × BCS (r^2: 0.89; RSD: 1.916; P: < 0.0001 and n = 28). These results indicated that BCS could be used as a predictor of the main body fat reserves in Pelibuey ewes.

Key Words: body condition, body energy reserves, energy balance

T526 The sexual behavior of male goats treated with exogenous testosterone is affected by the feeding level. Ma de Santiago Miramontes*[1], J. F. Alvarado-Espinosa[1], F. G. Véliz-Deras[1], O. Ángel-García[1], A. Gonzalez-Tavizón[1], M. G. Calderón-Leyva[1], L. I. Vélez-Monroy[2], J. D. Hernández-Bustamante[1], and M. Mellado[1], *[1]Universidad Auonoma Agraria Antonio Narro, [2]Instituto Nacional de Investigaciones Agricolas y Pecuarias.*

A successful male effect is supported on sexually active bucks, therefore the aim and the present study were to determine the effect of feeding level + testosterone (T_4) treatment, on search and consummation behaviors in bucks (mixed-breed in arid region of Mexico; 26° N) during the sexual rest. Four groups were used (n = 5 c/u; Body condition Score, 2.5 ± 0.12 points, 1–4 scale). On February 2nd, one group: NT_4 (Normal feeding + T_4) received 0.5 kg of alfalfa hay, 1.1 kg of oaten hay and 0.2 kg of molasses/animal + 25 mg of T_4 IM; NC group (Normal feeding, no T_4) received a same feeding +1 mL of NaCl (as placebo); LT_4 group (Low feeding + T_4) received 0.3 kg of alfalfa hay, 0.5 kg of oaten hay and 0.15 kg of molasses per animal + 25 mg of T_4, the LC group (Low feeding, no T_4) received a same feeding + 1 mL of NaCl. T_4 and NaCl was applied every 3rd day for 3 weeks. On April 14, the sexual behaviors (search; ano-genital sniffs, approaches, vocalizations, flehmen. Consummation; attempts to mount, mounts, mounts with a scabbard, mounts with ejaculation) were individually registered using a estrogenized female. The behaviors were compared with a χ^2 test (MYSTAT 12).The Body Condition Score at the end of the study was: LT_4 & LC = 1.7 ± 0.2 and: NT_4 & NC = 2.4 ± 0.13. The search behaviors showed statistical differences ($P < 0.05$) for all groups (NT_4, 53%; LT_4, 24%; LC, 15%; NC, 8%), Likewise, on consummation ($P < 0.05$) for all groups (NT_4, 54%; LT_4, 32%; LC, 10%; NC, 4%). We conclude that an appropriate

feeding, improves the sexual behaviors of search and consummation in male goats treated with exogenous testosterone. These sexually active bucks would stimulate through the "male effect" the estrous behavior in mixed-bred anovulatory goats in the arid region of northern Mexico.

Key Words: goat, testosterone, male effect

T527 Pre-weaning and post-weaning growth performance of F_1 intact male Kiko × Boer goat kids from does divided into high and low lines for parasite resistance—One year summary.
Kelsey L. Basinger*[1,2], Bruce C. Shanks[1], Jason K. Apple[2], James D. Caldwell[1], Luke S. Wilbers[1], Chevise L. Thomas[1], Whitney M. Haslag[1], Shelby N. Kleithermes[1], and Amy L. Bax[1], *[1]Lincoln University, Jefferson City, MO, [2]University of Arkansas, Fayetteville, AR.*

Goats are becoming increasingly popular because of their potential economic benefits and their ability to compliment other livestock enterprises. However, gastrointestinal parasites are a serious constraint in goat production; one solution may be selection for parasite resistance. Therefore, the objective of this study was to evaluate pre-weaning and post-weaning growth performance of F_1 intact male Kiko × Boer goat kids from does divergently grouped based on parasite resistance. Intact male F_1 Kiko × Boer progeny (n = 57; 3.0 ± 0.70 kg birth weight) from 2 lines of does with either a high resistance to internal parasites (HL; n = 34) or low resistance to internal parasites (LL; n = 23) were compared. Goat kids were born and managed on pasture with ad libitum access to creep feed until weaning at approximately 100 d of age. Kids were then placed in a drylot with ad libitum access to water, commercial goat mineral, a high-concentrate finishing diet, and were offered mixed-grass hay at approximately 10% of their total diet daily. Pre- and post-weaning weights did not differ ($P \geq 0.16$) between HL and LL; however, weights across pre- and post-weaning weigh periods collectively tended ($P = 0.10$) to be heavier for LL than HL. As expected, weight differed ($P < 0.0001$) across all weigh periods. Weight was regressed over all weigh periods using linear equations to graphically display differences in kid growth rate. Kids from LL had lower birth weights than HL, but, by weaning, weights of LL kids tended to increase at a greater rate (slope difference, $P = 0.15$) than that of HL kids (pre-wean $\text{weight}_{LL} = 2.99776 + [0.13235 \times \text{weigh d}]$, $R^2 = 0.45$ vs. $\text{weight}_{HL} = 4.3369 + [0.1045 \times \text{weigh d}]$, $R^2 = 0.46$). Yet, after weaning, weights of LL and HL kids increased at virtually the same rate (slope difference, $P = 0.81$). Maternal contributions to weaning weight differences are typically attributed to dam's milking ability; thus, these preliminary results indicate that HL does may not have the same milk production as LL does when grazing parasite-infected pastures.

Key Words: goat, parasite, growth

T528 Effect of adding zeolite (*clinoptilolite*) on growth performance and carcass characteristics in hair lambs fed a finishing diet.
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Mexican sheep meat production covers only 56.52% of its demand; thus, an alternative to the national sheep production shortage is intensive completion based on the supply of potential of byproducts, additives and minerals that could be included in the diets for intensive fed sheep to reduce the finishing time. Clinoptilolite zeolite are hidrated alcaline aluminosilicates with known capacity of increasing digestion time, thus increasing the digestive efficiency of feed nutrients. To determine the effect of the addition of 4 increasing levels of zeolite (0, 1.5, 3.0, 4.5%) in completely mixed diets for sheep on growth performance and carcass characteristics, 40 male sheep 1/4 Kathadin × 3/4 pelibuey were used. According to a randomized complete block design, sheep were grouped into 5 blocks with 4 pens each and each treatment randomly sorted into each block. The test lasted 75 d and weighings were carried at 28, 56 and 75 d respectively. The treatments used were: T1) 0% Zeolite (16.5% CP and 1.38 Mcal / kg ME), T2) 1.5% Zeolite (16.0% CP and 1.35 Mcal / kg ME), T3) 3% Zeolite (16.5% CP and 1.32 Mcal / kg ME) and T4) 4.5% zeolite (15.1% CP and 1.29 Mcal / kg ME). The feed was offered in twice a day at 8:00 and 14:30, adjusted to 3.0% of their initial body weight amount and gradually adjusted based on the excess or shortage of existing food the next day. Feed was served in a 40:60 ratio in the morning and afternoon respectively. At the end of the trial animals were killed, and 24 h after slaughter carcass data were obtained. In the productive performance data, no effect in final weight ($P = 0.50$), daily weight gain ($P = 0.50$) and dry matter intake ($P = 0.08$) was observed due to the effect of addition of zeolite. Also, no effect owed to zeolite added to diet was observed in HCW ($P = 0.98$) or rib-eye area ($P = 0.64$). It is concluded that clinoptilolite zeolite can be replaced up to 4.5% in substitution of corn and soybean, ingredients of high economic impact, with no significant effect in productive of carcass variables.

Key Words: additive, mineral, ruminant nutrition

T529 Indices of enzyme activities and atherogenicity of lamb meat fed high levels of crude glycerin.
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The objective was to evaluate the effects of corn replacement by crude glycerin (CG) in diets with high-concentrate diets and low starch on enzyme activities and atherogenicity index of lamb meat. Forty Santa Ines lambs (23.5 ± 1.35 kg BW) were assigned to a randomized block design with 5 treatments: 0, 7.5, 15, 22.5, and 30% of CG on dry matter basis. The diet with 30% of CG promoted total replacement of corn. Diets consisted of Tifton-85 hay, corn, crude glycerin (83% glycerol), corn gluten meal, corn oil, urea, sunflower meal, soybean hulls and mineral. All diets had around 18% roughage and 82% concentrate. The Animals were housed in individual pens and fed ad libitum twice daily at 0700 and 1600 h. The experimental period had 72 ± 7 d of duration and the animals were slaughtered when reached 38 kg BW. The indices of enzyme activities Δ^9-desaturase on C16 and C18 fatty acids and enlogase, as well as atherogenicity index (indicator of the risk of cardiovascular disease) were calculated using the concentration of fatty acids from *Longissimus* muscle. Orthogonal contrasts were used to determine the linear and quadratic effects of CG and also contrast of 0% CG vs. CG treatments were used. The enzymatic activity indexes for elongase and Δ^9 desaturase 16 and 18 increased linearly with increasing dietary crude glycerin ($P \leq 0.02$). Activity indexes were also higher in the meat from animals fed CG, regardless of concentration, when compared with meat from animals fed without CG ($P \leq 0.04$). Increasing CG linearly reduced the meat atherogenicity index ($P < 0.01$). Moreover, the index was lower in animals fed CG, regardless of concentration, in comparison to animals fed CG ($P < 0.01$). The CG can provide higher activity of

enzyme linked to production of CLA and oleic fatty acid in lamb meat. The CG has potential to decrease the risk of cardiovascular disease.

Key Words: cardiovascular disease, CLA, glycerol

T530 Performance of lambs fed corn stalk silages plus pig excreta, poultry litter and urea, or cane molasses and bakery by-products. Daniel Trujillo-Gutiérrez[1], José L. Bórquez-Gastelum[1], Sergio S. González-Muñoz*[2], Mario A. Cobos-Peralta[2], and Ignacio A. Domínguez-Vara[1], *[1]Universidad Autónoma del Estado de México, Toluca, Estado de México, México, [2]Colegio de Postgraduados, Montecillo, Estado de México, México.*

This experiment was carried out to evaluate the effect of corn stalk (CS) silage diet (145 g CP/kg DM; 2.4 Mcal/kg DM) plus 3 nitrogen sources (pig excreta, PE; poultry litter, PL; urea, UR) and 2 energy sources (sugar cane molasses, CM; bakery by-products, BBP). Composition (g/kg DM) of silages was (1) 384. Six CS; 384.6 PL; 230.8 CM or BBP; (2) 294.1 CS; 529.4 PE; 176.5 CM or BBP; (3) 630.0 CS; 30 UR; 340 CM or BBP. Diet contained (g/kg DM) silage 400:600 supplement (corn grain, soybean meal, wheat bran, fish meal, vitamins and minerals). The experimental design was completely randomized, using 30 Criollo lambs (24.05 ± 3.68 kg initial BW) housed in individual cages during 60 d. Data were analyzed with PROC MIXED for average daily gain (ADG) and dry matter intake (DMI) utilizing initial body weight as covariable, whereas PROC GLM and Tukey test ($P < 0.05$) were used for carcass variables. Qualitative variables (color of meat and fat) were analyzed by U-Mann-Withney test. No differences ($P > 0.05$) were found for ADG (161, 175, 163, 160, 161, 150 g/day), DMI (792, 856, 894, 962, 961, 767 g DM/day) for PL-CM, PL-BBP, PE-CM, PE-BBP, UR-CM and UR-BBP, respectively. Rib eye area was larger for lambs fed PE-BBP (14.26 cm^2), as compared with UR-CM (9.34 cm^2). Empty BW was lower ($P < 0.05$) for lambs fed corn stalk silage plus UR and CM (27.7 kg), as compared with those fed CS, PE and CM (34.8 kg). Corn stalk silage plus UR and CM decreased ($P < 0.05$) carcass width (23.04 cm), as compared with corn stalk silage plus PE and BBP. No differences were found for the qualitative variables among treatments ($P > 0.05$). Therefore, it may be concluded that lambs fed corn stalk silage plus pig excreta and bakery by-products showed better carcasses.

Key Words: corn stalk, waste and by-product, lamb