SMALL RUMINANT I

1899 (M365) A simple method to estimate feed required for maintenance of small ruminants.

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A simple means to estimate feed required for maintenance by Katahdin (K) sheep and Spanish (S) goats (initial BW = 30.6 ± 0.40 and 21.8 ± 0.27 kg, respectively; 8 mo old) by frequent BW measurement and adjustment of feed offered was evaluated. Ten K and S wethers in 1.05 × 0.55 m pens were fed grass hay (64.1% NDF, 10.4% CP, and 55.4% TDN; DM basis), initially at 58 and 55 g/kg $BW^{0.75}$ (air-dry basis; i.e., ME intake of 427 and 452 kJ/kg $BW^{0.75}$, respectively), at 0800 h for 5 wk. Three times weekly BW was measured at 1300 h in 50-g increments, and hay fed was varied thereafter by 0–5% (i.e., ≤ 40 g/d) to maintain BW. Breed (732 and 538 g for K and S, respectively; SE = 11.5) and wk (625, 653, 632, 623, and 641 g for wk 1, 2, 3, 4, and 5, respectively; SE = 9.4) affected daily air-dry intake (ADI; $P < 0.001$), although breed × wk did not ($P = 0.508$). Variation among days in ADI differed between breeds in wk 2 (SD = 4.68 and 14.5 g; $P = 0.002$) and 5 (SD = 64.6 and 31.1 g for K and S, respectively; $P = 0.044$). Body weights were smoothed using LOWESS and fitted by a segmented polynomial with the middle segment constrained to a flat line. Regression coefficients of the first and third segments and the two join points were estimated using nonlinear regression. The average of the first and second join points was 16 and 28 d, respectively, indicating BW stability between these times. Also, ADI of each wether was regressed against ADG in 2- and 3-d periods based on unsmoothed BW in wk 2–5, 3–5, 2–3, 2–4, 3–4, and 4–5. The only weeks without an intercept different from 0 ($P > 0.10$) were 2–5 and 2–4. Hence, the intercept of wk 2–4 regressions was used to determine feed required for maintenance, with values of 727 and 538 g ADI (SE = 11.6), corresponding to a ME requirement for maintenance of 447 and 426 kJ/kg $BW^{0.75}$ for K and S, respectively. Variability was homogenous between breeds ($P = 0.867$), although intercept SE averaged 6.0 and 12.9 g ADI for K and S, respectively. In conclusion, after 2 wk of adaptation, frequent weighing and change in offered feed for 2 wk may offer a relatively simple means of estimating maintenance feed needs of small ruminants.

Key Words: maintenance, goats, sheep

1900 (M366) Dermal application of PGF2a for estrus synchronization in goats: Preliminary feasibility.

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The administration of vaccines and other veterinary products can result in abscesses and scar tissue within the carcass of the animal. The use of PGF_{2a} for estrus synchronization purposes only increases the likelihood of these occurrences. The objective of this study was to test the efficacy of PGF_{2a} dissolved in DMSO, a needle-less, transdermal delivery, compared with intramuscular injections of PGF_{2a}. In this study a total of 16 small cross-bred Spanish breed-type goats were used. The injection group received two 15 mg injections (im) of PGF_{2a} while the transdermal group received two 15 mg administrations dissolved in 2 mL of DMSO (placed between shoulder blades) both 10 d apart. All does were paint marked and exposed to a mature buck for 4 d. Approximately 35 d from buck removal all does were evaluated for pregnancy via ultrasonography. Statistical comparisons were performed in SAS using a chi-square analysis. There were no significant differences between the mean ± SD BCS (1 to 5 scale) for does receiving the injection protocol (1.7 ± 0.7) and does receiving the transdermal protocol (2.0 ± 0.8). Also there were no significant differences in the number of transdermal does displaying estrus (within 4 d) (5/7, 71%) compared with injection does (4/9, 44%). The pregnancy rate was higher ($P > 0.05$) for transdermal does (4/7, 57%) compared with injection does (2/9, 22%), however there was no significant different ($P > 0.05$) in the number of pregnant does from those showing estrus in the transdermal (3/5, 60%) and injection group (2/4, 50%). There was no difference ($P < 0.05$) in the time from last PGF_{2a} to onset of estrus among transdermal (58 ± 13 h) and injection does (42 ± 12 h). A total of 9 out of 16 does (56%) displayed estrus within a 4 d time period where only 19% would be expected randomly. These results suggest that administration of PGF_{2a} via DMSO (transdermal) should produce similar results as im injection for purposes of estrus synchronization. This procedure may result in a method of estrus synchronization without increasing carcass damage to goats.

Key Words: goats, PGF_{2a}, DMSO, estrus synchronization

1901 (M367) *Longissimus* muscle fatty acid profile of crossbred Boer goat kids fed diets containing crude glycerin. M. O. M. Parente*[1], K. S. Rocha[1], H. N. Parente[1], E. M. Ferreira[2], R. D. C. R. E. Queiroga[3], A. S. M. Batista[4], R. M. S. Gomes[1], P. R. O. Silva[1] and J. S. Araújo[1], *[1]Universidade Federal do Maranhão, Chapadinha, Brazil, [2]Escola Superior de Agricultura Luiz de Queiroz- ESALQ/ USP, Piracicaba, Brazil, [3]Universidade Federal da Paraíba, João Pessoa, Brazil, [4]Universidade do Vale do Acaraú, Sobral, Brazil*

Crude glycerin is a co-product of biodiesel production with a high concentration of glycerol. Due to the high production of biodiesel, there is a wide availability of crude glycerin and it is becoming an interesting ingredient for animal nutrition. Most studies focus on the sheep as small ruminants, while limited research exists evaluating crude glycerin in the diet of goat kids. Twenty crossbred Boer goat kids (20.8 ± 2.9 kg of BW at slaughter) were used in a randomized complete block design to determine the effect of partial replacement of corn by crude glycerin on *Longissimus* muscle fatty acid profile. Kids were penned individually for 51 d and fed an isonitrogenous (14.0 ± 0.2% CP, DM basis) diet composed of 70% concentrate and 30% forage (Coastcross Bermudagrass hay). Increasing levels of crude glycerin (80.0% glycerol, DM basis) were 0, 4, 8 or 12% corresponding to the experimental diets G0, G4, G8 and G12, respectively. Total lipids of muscles were extracted, esterified and methylated. Methyl esters were separated by gas chromatography (VARIAN 430-GC, California, USA) using a 60 m capillary column. Orthogonal polynomials for treatment responses were determined by linear, quadratic, and cubic effects. Effects were declared significant at $P < 0.05$, and trends are discussed between $P > 0.05$ and $P < 0.10$. Linear decrease ($P < 0.05$) for linoleic acid (3.57, 2.84, 3.76 and 2.33) and w6:w3 ratio (10.61, 9.71, 7.26 and 7.18 for G0, G4, G8 and G12, respectively) were observed with crude glycerin inclusion. The proportion of capric and eicosanoic acids tended ($P = 0.06$) to increase linearly. Saturated, Monounsaturated and Polyunsaturated fatty acids were not affected by treatments. In conclusion, the partial replacement of corn by crude glycerin cause a little effect on meat fatty acid profile.

Key Words: co-product, meat, quality

1902 (M368) Performance and carcass characteristics of finishing goat kids fed diets containing crude glycerin. M. O. M. Parente*[1], K. S. Rocha[1], H. N. Parente[1], E. M. Ferreira[2], I. G. R. Araújo[1], R. C. Rodrigues[1], R. M. S. Gomes[1] and P. R. O. Silva[1], *[1]Universidade Federal do Maranhão, Chapadinha, Brazil, [2]Escola Superior de Agricultura Luiz de Queiroz- ESALQ/USP, Piracicaba, Brazil*

The crude glycerin (co-product of biodiesel) has the potential to partially replace corn, because glycerol (an 80% constituent of crude glycerin) is converted to propionate in the rumen and acts as a precursor for hepatic glucose synthesis. However, most studies focus on the sheep and beef cattle, while limited research exists evaluating crude glycerin in the diet of goat kids. Therefore, the objectives of this trial were to determine the effects of partial replacement of corn by crude glycerin on performance and carcass characteristics of goat kids. Twenty crossbred Boer goat kids (initial BW of 17.08 ± 2.1 kg and 110 d old) were used in a randomized complete block design according to initial BW and age. Kids were penned individually during 51 d and fed an isonitrogenous (14.0 ± 0.2 CP, DM basis) diet composed of 70% of concentrate and 30% of forage (coastcross hay). Increasing levels of crude glycerin (80.0% glycerol, DM basis) were 0, 4, 8, or 12% corresponding to the experimental diets G0, G4, G8 and G12, respectively. Orthogonal polynomials for treatment responses were determined by linear, quadratic, and cubic effects. Effects were declared significant at $P < 0.05$ and trends are discussed between $P > 0.05$ and $P < 0.10$. Body weight (BW), average daily gain (ADG), G:F, dry matter intake, protein intake and ether extract intake were not affected by glycerin as a replacement for ground corn. Dry matter intake was 0.58, 0.65, 0.54 and 0.59 kg/d while ADG was 106, 106, 90, and 94 g for G0, G4, G8 and G12, respectively. The NDF intake tended ($P = 0.08$) to decrease linearly. Carcass characteristics (hot carcass weight, hot carcass yield and subcutaneous fat thickness) were unaffected by crude glycerin addition. Adding up to 12% crude glycerin to finishing kids does not affect the performance and carcass characteristics.

Key Words: Boer, cost of production, growth

1903 (M369) Effect of reducing dietary cation-anion difference on acid-base balance, plasma minerals level and anti-oxidative stress of female goats. W. X. Wu* and Y. Yang, *College of Animal Science, Guizhou University, Guiyang, China*

Reducing dietary cation-anion difference (DCAD, Na^+K-Cl-S, mEq/kg DM) has been proved an effective way to prevent milk fever in dairy cows. Based on the similar physiological gastro-intestinal tract anatomy and metabolic process between female goats and dairy cows, this study was conducted to evaluate the effects of varying DCAD on fluid

acid-base status, plasma mineral concentration and anti-oxidative stress capacity of female goats. Urinary pH, plasma Ca, P and Mg; and anti-oxidative stress indices of total superoxide dismutase (T-SOD), hydrogen peroxide (H_2O_2), glutathione peroxidase (GSH-Px) and malondialdehyde (MDA) were determined to evaluate the effect. Forty-eight Guizhou black female goats (15 ± 1.9 mo old, 22.3 ± 3.75 kg live weight) were randomly allocated to 4 blocks of 12 goats each and fed 1 of 4 diets that differed in DCAD level. Levels of DCAD were preliminarily designed to be control (+150 mEq/kg DM, CON), high DCAD (+300 mEq/kg DM, HD), low DCAD (0 mEq/kg DM, LD) and negative DCAD (-150 mEq/kg DM, ND), respectively. A commercial anionic salts (Animate) and sodium bicarbonate ($NaHCO_3$) were supplemented to reduce and increase DCAD level, respectively. There was no difference in dry matter intake for 4 groups of goats. Urine pH was aggressively decreased ($P < 0.0001$) with reduced DCAD and there was a strong association between DCAD and urine pH ($R^2 = 0.793$, $P < 0.0001$). Compared with CON and HD, feeding of LD and ND resulted in greater ($P < 0.05$) plasma Ca concentration. Plasma P level was increased ($P < 0.05$) when anionic salts were supplemented. The DCAD alteration did not affect ($P > 0.05$) plasma Mg level. There was no significant ($P > 0.05$) difference in plasma GSH-Px activity and H_2O_2, but anionic salts supplementation in LD and ND significantly increased ($P < 0.05$) plasma T-SOD activity and tended to reduce MDA ($P < 0.1$) over HD and CON. Results from this study indicated that reducing DCAD could decrease urine pH and increase plasma Ca concentration of female goats. Specially, reducing DCAD was helpful to enhance oxidative stress tolerance capability of female goats.

Key Words: dietary cation-anion difference, urine pH, plasma calcium, anti-oxidative stress, female goats

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1904 (M370) Effect of dietary linseed supplementation on milk fatty acid profile in dairy goats with different α^{S1}-casein (CSN1S1) genotype.

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In this study, the effects of dietary supplementation with extruded linseed on milk fatty acid profile of dairy goats with different α-^{s1} casein (CSN1S1) genotype are investigated. A flock of 68 Alpine goats were genotyped by IEF at the CSN1S1 locus. Ten were selected for the experiment: 5 homozygous for the weak *F* allele (*FF*) and 5 heterozygous for a strong allele (*AA or BE*). Goats of each genotype (weak and strong) were allocated into two groups: one was the control (CON) and one was supplemented with 150 g/d of extruded linseed (LIN). The trial lasted 8 wk. Data were analyzed using a mixed linear model that included the period, diet, genotype and diet × CSN1S1 genotype interaction as fixed factors, and the goat as random factor. Results confirmed the lower protein content (-11%) and higher milk yield (+26%) in weak genotype. A significant interaction diet x genotype was found for fat content: it was higher in LIN compared to CON only in the strong genotype (3.4 vs. 4.0%), whereas it did not change in weak genotype (3.3 vs. 3.2%). Goats fed LIN had greater proportions of vaccenic acid (18:1 trans11), CLA c9t11 and 18:3n-3 than goats fed CON. The genotype affected some FA: in particular the weak group showed a higher proportion ($P < 0.05$) of linoleic (2.5 vs. 2.1 g/100 g total FA), CLA c9t11 (0.8 vs. 0.6 g/100 g total FA), C16:1 and C22:4n6, and a lower proportion of stearic (7.4 vs. 8.6 g/100 g FA) compared to strong. Furthermore, the delta9 desaturation ratios were higher in weak CSN1S1 genotypes for C14 and trans11 C18:1. This study evidenced the impact of genetic variants of CSN1S1 on milk fat content and composition. *Acknowledgements: research funded by Fondazione Banco di Sardegna project*.

Key Words: goat milk, α_{S1}-casein, linseed diet by genotype interaction

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1905 (M371) GIS hot-spot analysis of pasture utilization of two separate herds of goats over time.

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An understanding of pasture landscapes that promotes or hinders efficient utilization is essential for proper management. The objective of this study was to characterize pasture utilization of two separate herds of goats utilizing the same pasture in different years. The study area was a 14.1-ha pasture of predominantly fescue, bermudagrass, panicums, bahia grass, and broomsedge bluestem but was reverting to a wooded area containing predominately pecan, elm, and honey locust sapling-size trees. In year one (Y1), the study area was stocked with 36 Spanish goats, of which 10 were fitted with GPS collars and in year two (Y2), the study area was stocked with 58 Spanish goats, of which 19 goats were fitted with GPS collars. Different goats were used in Y1 and Y2. For the first 2 wk of pasture introduction, goats wore the collars, which recorded a fix every 5 min. An average nearest neighbor analysis yielded a z score of -150.2 ($P < 0.01$) for Y1 and -150.1 ($P < 0.01$) for Y2, indicating highly clustered events for both years. A GIS point-in-polygon (PiP) analysis was conducted for each year using the same grid (1792 10 × 10 m squares) for each year and with unique grid identifiers. Moran's I, a measure of spatial autocorrelation, indicated a peak at 30 m and that value was used in the hot-spot (Getis-Ord Gi* statistic) analysis conducted on the resulting PiP. Based on the resulting z-scores from the hot-spot analysis, each square was classified as very low (VL), low (L), moderate (M), high (H), and very high (VH) usage. Y1 had greater ($\chi^2 = 13.89$, $P < 0.01$) VL and lower VH squares (82% and 1%, respectively) compared with Y2 (80% and 3%, respectively). Hot-spot analysis revealed

two areas of H and VH usage for both years. One of the areas was a small grove of trees that had almost a 100% overlay for both years. The degree of similarity in pasture usage was high as indicated by a Spearman's rank correlation coefficient (0.76; $P < 0.01$) of the square z-scores for Y1 and Y2. Even though the two herds of goats never interacted and were separated by time, their pasture utilization was strikingly similar. Further work is needed to investigate the physical features of the pasture to understand the causes behind this similarity.

Key Words: GIS, GPS, goats

1906 (M372) Model evaluation of methane emission from goats.

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There have been several attempts to develop mathematical models to predict methane (CH_4) emissions because they can be easily applied in practical situations to estimate diet ME. Because studies evaluating the suitability of different mathematical models available for methane emission prediction in goats are lacking, this study was performed to evaluate 3 empirical models (Blaxter and Clapperton, Moe and Tyrrel, Pelchen and Peters) based on their ease of application, common use and their feasible input variables. The prediction ability of those models was evaluated using a database of two metabolism trials, in which 45 individual measurement of methane emission from goats (averaging 30 ± 2.93 kg BW) was taken using SF_6 technique. Models were evaluated by regressing residual (observed minus predicted) values on the predicted values centered on their mean values. The intercepts of the regression equations were used to estimate mean biases, whereas linear biases were assessed using the slopes of the regression equations. Also, using the same database, an empirical model was developed taking into account the coefficient of determination (R^2), forward selection, and Cp of Mallows. Observed DMI ranged from 280 to 1300 g/d. Observed methane emission ranged from 8 to 22 g/d, which represented methane losses ranging from 3.5 to 11% of dietary GE intake. Results showed a significant mean and linear biases ($P < 0.001$) for all models, showing that these models over predict methane emissions from goats. Moe and Tyrrell model presented the highest linear bias which was −65.5 g/d at the maximum predicted value (86.9 g CH_4/d). Pelchen and Peters model exhibited the lowest magnitude of the linear bias, which was less than 2 g/d at the minimum (11.5 CH_4/d) and -10 g/d at the maximum (27 g CH_4/d) predicted methane values. The linear bias of Blaxter and Clapperton model ranged from approximately 4 g/d (at the minimum predicted values) to -15 g/d (at the maximum predicted values). A simple regression equation was developed using same database. Accordingly, the best-fit linear model that represents goat methane emission was defined as follows ($R^2 = 0.51$, RMSE = 2.23, $P < 0.001$, CP = 11.4): CH_4(g/d) = 4.36 ± 2.07 + 0.17 ± 0.06 × BW (kg) + 0.006 ± 0.001 × DMI (g/d).

Key Words: bias, empirical model, CH_4

1907 (M373) The effect of some herbal plants on plasma metabolites of lactating goats.

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The objective of this study was to investigate the effects of a dried mixture of 7 herbal plants including thyme, mint, oregano, cumin, camel thorn, garlic, and eucalyptus as a natural dietary additive on plasma metabolites of lactating goats. Twenty lactating goats (3 wk after kidding, 2–3 yr old, average BW = 34.45 kg) were used in a completely randomized design with 2 treatments for a 40 d trial. Treatments included (1) a control ration, consisting of barley and alfalfa (50:50 DM basis) without herbal plant mixture, and (2) control ration + 250 mg kg^{-1} body weight per day herbal plant mixture. Amount of basal diet for the 2 groups was 0.5 kg/head/d. Animals had free access to water and green fodder. Blood samples were collected at the end of experiment after morning feeding for determination of plasma glucose, triglyceride (TG), urea nitrogen (BUN), total protein and cholesterol concentrations. Results showed that mean concentration of plasma glucose (60.5 and 57.5 mg/dL), total protein (10.0 and 9.6 g/dL), BUN (21.5 and 24.2 mg/dL) and TG (31.5 and 30.3 mg/dL) were not affected by herbal plants, but cholesterol concentration (73.7 and 59.7 mg/dL was significantly lower in treatment 2 ($P < 0.05$). It is concluded that herbal plant mixture were used in this study significantly decreased cholesterol concentration in plasma of lactating goats.

Key Words: blood metabolites, herbal plants, lactating goat

1908 (M374) Seasonal variation influences the semen characteristics and freezability in Xinong Saanen goat.

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The aim of this study was to evaluate how season of ejaculate collection influences seminal quality parameters before and after freeze–thawing of Xinong Saanen buck semen. Ejaculates were collected from eight bucks and throughout the four seasons of 1 yr identified in the northern hemisphere (spring, summer, autumn and winter). During the study period, semen was collected at 10-d intervals during each season with an ar-

tificial vagina. Semen samples were evaluated by the combination of traditional and Computer-Assisted Sperm Analysis (CASA) semen assessment methods and sperm quality parameters (motility and morphology) were compared at fresh and after freeze–thawing, respectively. The results demonstrated that season of ejaculate collection influenced ($P < 0.05$) semen quality of Xinong Saanen bucks before freezing. During spring, summer and autumn, the ejaculate subjectively motility; volume; sperm concentration; sperm output and membrane integrity were higher ($P < 0.05$) than in the winter. The CASA also illustrated seasonal variation greatly affected semen motility kinetic parameters. An increase in the curvilinear velocity (CLV); straight line velocity (SLV); beat cross frequency (BCF) and amplitude of lateral head displacement (LHD) was observed during spring, summer and autumn, followed by a significant ($P < 0.05$) decrease during the winter. Furthermore, season of ejaculate collection influenced sperm freezability. Semen characters after freeze–thawing followed a phenomenon similar to that of the fresh ejaculate except in spring. In details, sperm quality was higher ($P < 0.01$) in summer and autumn than in spring and winter, in terms of total motile sperm (MS); rapidly progressive motile sperm (RPMS); CLV; SLV; average path velocity (APV); BCF and LHD base on the CASA. The membrane integrity and acrosome integrity were obtained from summer to autumn were higher ($P < 0.01$) than in spring and winter. Consequently, it can be said that Xinong Saanen bucks have distinct seasonal spermatogenic activity, with better semen quality characteristics being recorded during spring, summer and winter before freezing. Sperm from ejaculates collected during summer and autumn are more suitable for cryopreservation. Thus, it is possible to implement intensive goat breeding strategy with two kidding seasons in 1 yr to produce adequate quantities of goat milk and equalize the need for milk throughout the year, and moreover, the poor semen characteristics emphasize the need in avoiding making use of semen collection for cryopreservation purposes during spring and winter seasons of the year.

Key Words: Xinong Saanen goat, sensonality, semen characteristics, freezability, CASA

1909 (M375) Mean retention time of particulate matter through gastrointestinal tract of growing goat.

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The objective of this study was to evaluate mean retention time (MRT) of particulate matter through gastrointestinal tract (GIT) of growing goat of different sex and body weight. A total of 58 Saanen goats (20 intact males, 20 castrated males and 18 females) were housed in individual pens with free access to water. Then, the goats of each sex were randomized in 3 different slaughter BW (around 15, 22, 30 kg). They were fed ad libitum with the same diet (45.4% corn plant hay and 54.6% concentrate comprised), and diet was offered twice daily at 0700 and 1600 h. The animals were slaughter when reached 16.5 ± 0.9; 22.8 ± 1.3; 31.6 ± 1.5 kg of BW. Then, GIT was removed and separated into reticulorumen, omasum, abomasum, small intestine, cecum and colon. The content of each GIT compartment was sampled. To determine the passage rate, we used the ruminal emptying technique of slaughtered animals. The indigestible NDF (iNDF) was used as internal marker. The concentration of iNDF was determined by incubating the samples in rumen-fistulated cattle per 288 h, using Ankom bags (F57). The experiment was analyzed as split plot designed (3 sex and 3 slaughter BW) using PROC MIXED of SAS. The effect of slaughter BW was decomposed into 2 orthogonal polynomial contrasts (linear and quadratic) and the effect of sex was compared by Tukey test. The significance was declared at $P \leq 0.05$. Sex did not influence the MRT for all compartments ($P > 0.05$). On average the reticulorumen retention time was 35.8 h (67% of retention in GIT) and it was similar between sex and BW. As BW increased the MRT in the omasum increased linearly and the MRT in the abomasum decreased linearly ($P \leq 0.05$). It was observed a significant interaction between sex and BW for MRT of omasum and colon ($P < 0.01$). Whereas, females with 22 kg of BW presented lower MRT compared to males (intact and castrated) in the same BW. In conclusion, the increase of BW mainly influenced MRT in the omasum and abomasum compartment. Females present different pattern of MRT for omasum and colon than males.

Key Words: body weight, iNDF, sex

1910 (M376) Goat kids of different genders change the proteic metabolism when subjected to feed restriction.

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The objective of this study was to evaluate the effect of gender and feed restriction on proteic metabolism of 72 Saanen goat kids (24 intact males, 24 castrated males and 24 females) with initial BW of 15.8 ± 0.17 kg. At the beginning of the experiment 6 animals of each gender were slaughtered with 15 kg of BW to estimate their initial body composition, these animals were considered baseline for the comparative slaughter technique. The remaining animals of each gender were distributed into 6 groups of 3 animals subjected to different

levels of feed restriction (ad libitum, 25% and 50% feed restriction). A whole group was slaughtered when the kid fed ad libitum reached 30 kg BW. Protein retention was estimated by the difference between the final and initial body composition. Blood samples were collected from all animals every 10 d, in a total of 7 collections for blood metabolites and 5 collections for hormones profile. In these samples we evaluated total protein, albumin, urea, creatinine, γ glutamyltransferase (GGT), creatine kinase (CK), triiodothyronine (T3) and IGF-I. Data were analyzed as split plot design, using mixed model of SAS. The retention of body protein (kg) was not affected by gender, only showing a linear decrease with the increase of feed restriction ($P < 0.0001$). The total protein, creatinine and CK seric levels increased with the increase of experimental time ($P < 0.05$). When fed ad libitum, urea concentration was highest in females (58.1 mg/dl), followed by castrated males (54.3 mg/dl) and intact males (51.2 mg/dl; $P = 0.0154$). When the goats were subjected to 25% of feed restriction, the difference between genders was no longer observed, however, when subjected to 50% of feed restriction castrated males showed the highest serum urea level (54.02 mg/dl). The GGT activity in intact males was higher ($P < 0.0001$) when they were fed ad libitum (51.31 ± 1.58 U/L) and decreased with the increase of feed restriction. Whereas castrated males fed ad libitumpresented lower activities of GGT compared to those fed restricted and females remained constant at all levels of feed restriction. IGF-1 plasmatic were similar between castrated males and females (81.3 ng/ml), and lower than found in intact males (106.20 ng/ml; ($P < 0.0001$). Intact males showed lower concentrations of T3 compared to females ($P < 0.05$). Despite goats of different gender show similar protein accretion, they act physiologically different when subjected to feed restriction. Males changed their proteic metabolism to keep the protein synthesis.

Key Words: metabolism, sex

1911 (M377) Effects of dietary chromium supplementation on performance, liver and blood metabolites of kids. A. Emami[1], M. Ganjkhanlou[2], A. Zali[2], A. Akbari-Afjani[3] and M. Dehghan-Banadaky[*2], [1]*University of Birjand, Birjand, Iran,* [2]*University of Tehran, Tehran, Iran,* [3]*University of Zanjan, Zanjan, Iran*

This study was performed to determine the effects of supplementing chromium-methionine (Cr-Met) on fattening performance, liver and blood metabolites in Mahabadi goat kids. Thirty-two male kids (BW = 22 ± 2 kg, 4mo) were used in a completely randomized design to one of 4 treatments: control, 0.5, 1.0 and 1.5 mg Cr as Cr-Met/animal/d. The diet was formulated to meet the requirements recommended by NRC with 30% forage (alfalfa and corn silage): 70% concentrate ratio as TMR. The diets were the same, except for top-dress addition of Cr-Met fed in 2 equal meals (0700 and 1700 h) and orts were collected before morning meal. Animals were housed individually for 84 d. Animals were weighed in 21-d intervals. For measuring blood metabolites (glucose and cholesterol), blood samples were collected every 21 d before morning feeding. The end of trial following 16h fasting kids were slaughtered and some of the liver were immediately stored at -20C for assessing moisture, fat and crude protein content. Data considering dry matter intake(DMI), average daily gain (ADG) and blood metabolites were analyzed by Mixed Model procedure and liver metabolites with GLM MODEL procedure and adjust Tukey-Kramer (SAS 9.1). Intake (DMI), ADG, liver metabolites and blood plasma cholesterol were not significantly affected by dietary Cr-Met ($P > 0.05$). However supplementing diet with chromium significantly decreases plasma glucose relative to the control ($P < 0.05$). In conclusion, the results of this experiment indicated that dietary supplementation of Cr-Met failed to affect growth performance, plasma cholesterol and liver metabolites but decreased plasma glucose of Mahabadi goat kids.

Key Words: chromium methionine, blood metabolite, Mahabadi goat kid

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1912 (M378) Effect of Tasco on fecal egg counts and packed cell volume in meat goats. N. C. Whitley*, S. H. Oh, K. Moulton, R. Franco, S. B. Routh and C. Kyle, *North Carolina A&T State University, Greensboro*

The effect of Tasco on goat gastrointestinal nematode parasite fecal egg counts (FEC) and packed cell volume (PCV) was investigated in two experiments (Exp) using Boer and Boer crossbred goat kids. In Exp 1, female goats at 264 ± 2.5 d of age and 31 ± 0.99 kg BW were artificially infected with 2000 L3 *Haemonchus contortus* every other day for 6 d. At 56 d post-infection, 20 goats were assigned to treatments of Control (Con) or Tasco (TA), $n = 10$/treatment. For Exp 2, 36 naturally-infected, 119 ± 2.4 d old female and castrated male goats at 22.5 ± 0.4 kg were assigned to Con and TA ($n = 18$/treatment). Pre-treatment FEC and BW means were similar. Goats were individually housed in 1.5 × 1.5 m pens with ad libitum water access. A commercially pelleted 17% CP meat goat feed was used. For Exp 1, goats were fed Tasco at 2% feed offered or a similar amount of their daily feed ration (2% BW with coccidiostat) mixed with 20 mL corn oil 2–3 h prefeeding for 14d. For Exp. 2, Tasco was added at 2% DM by the feed company before pelleting (no coccidiostat). Both TA and Con pre-weighed rations were fed daily to allow for 10% orts for 21d. Goats were weighed on d 0 and 21 (Exp 2) and fecal sampled at d 0, 7, and 14 (and d 21 for Exp 2) for FEC by modified McMaster's technique. Percentage PCV was measured in jugular blood samples on d 0, 7, 14, and 21 (d 0 and 14 only for Exp 1). Orts were weighed on d 7 (Exp 1 and 2), and d 14 and 21 (Exp 2). For Exp 1, half the goats regularly left unconsumed Tasco. However, analyzed separately (con-

sumed all vs. part) or together, FEC was not impacted by TA, while PCV was higher ($P < 0.01$) for TA (33.3 ± 0.56%) than Con (30.3 ± 0.58%). For Exp 2, FEC (1820 ± 156 epg), PCV (29.6% ± 0.4%), ADG (0.15 ± 0.02 kg) and FE (0.19 ± 0.02 kg gain/kg feed) were not impacted by TA. Pre-treatment fecal larval identification indicated 84.5% *H. contortus*. Intake was not influenced by TA. Overall, Tasco addition to the diet did not have consistent effects on PCV and FEC in goats and did not impact growth or feed efficiency.

Key Words: goat, parasites, Tasco

1913 (M379) Pharmacokinetic processes of lithium used for food aversion in sheep and goats.

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Conditioned taste aversion (CTA) is a useful management tool to control weeds in commercial crops. Lithium chloride (LiCl) is a safe product used in livestock CTA studies to induce aversion to palatable plants. Despite the use of LiCl in numerous studies, there is a lack of information on the pharmacokinetics that accompany different CTA doses in domestic livestock. This information is needed for using selective grazing in practice, and to avoid any possible soil contamination by excreted Li. With this aim, we studied the kinetics of Li elimination in 2 experiments: 1) Murciano-Grandina lactating goats ($n = 6$) after a single dose of 200 mg LiCl/kg BW; and 2) Manchega dairy sheep, open and dry, after a single dose of 225 mg LiCl/kg BW. For Exp.1, goats were penned in metabolic cages for measuring daily milk yield, water and feed intake. Samples of urine, feces, milk and blood were collected over a period of 168 h. In Exp.2, ewes were maintained as a group in a pen with head lockers, where they were restrained at every sampling time for feces (rectum) and blood (jugular) collection over 192 h. Concentration of Li was measured by graphite furnace Atomic Absorption Spectrometry and data corrected for its basal concentration. Withdrawal period (Wp) was calculated with a statistical tolerance limit of 95% (EMEA/CVMP/036/95). Individual biological half-life ($t_{1/2}$) was calculated using PK Solutions computer program (Farrier, 1997). Results showed that plasma Li concentration reached a maximum at 4 h in lactating goats (14.5 ± 0.8 mg Li/L plasma) and 12 h in dry sheep (17.7 ± 0.8 mg Li/L plasma). Values of $t_{1/2}$ were 30.9 ± 2.1 and 40.3 ± 3.8 h for sheep and goats, respectively ($t = 2.39$; DF = 10; $P < 0.03$). In goats, recovery rate of administered Li was 101.7% at 96 h (urine, 92.4 ± 4.4%; feces, 6.5 ± 1.3%; milk, 2.8 ± 0.4%); however the estimated Wp established in feces was 9 and 11 d for sheep and goats, respectively. In conclusion, Li was fully eliminated in sheep and goats, but needed longer time than reported in other species (i.e., rat and human). LiCl can be used safely to induce CTA for controlling weeds by grazing in organic crops after a waiting period of approximately 1 wk before moving the animals to the crop. *Funded by Plan Nacional I+D+I AGL 2010–22178-C02–01.*

Key Words: conditioned aversion; small ruminants; lithium chloride

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1914 (M380) Influence of partial replacement of corn by crude glycerin on water consumption, feed intake and nutrient apparent digestibility.

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Glycerin is a co-product from biodiesel production and it can improve energy efficiency when replaces corn. Five Dorper x Santa Inês ram lambs (BW 59.7 ± 1.3 kg), cannulated in the rumen, were used in a 5 × 5 Latin Square design to determine the effects of partial replacement of corn by crude glycerin (CG) on water consumption, feed intake and nutrient apparent digestibility. Animals were fed a total mix ration composed of 90% concentrate and 10% coastcross hay. The diets were isonitrogenous (15.9 ± 0.2 CP, DM basis) and the crude protein content was adjusted by increasing soybean meal. Crude glycerin (83.6% glycerol, DM basis) was included in the ration at 0, 5, 10, 15 or 20% (DM basis), corresponding to the experimental diets G0, G5, G10, G15 and G20, respectively. The diet was fed ad libitum, once daily. Every experimental period lasted 19 d. The first 15 d were used to adapt the lambs with the diets and the remaining 4 d were used to determine daily feed intake, water consumption and fecal output. For total collection of feces, harnesses with collection bags were used to avoid contamination of feces by urine. Data were analyzed using the MIXED procedure (SAS Inst. Inc.) and the LSMEANS option was used to generate individual means. Orthogonal polynomials for diet responses were determined by linear, quadratic or cubic effects. CG did not affect ($P > 0.05$) water consumption (4.77, 5.02, 5.01, 5.25, 4.56 L/d), dry matter (1.56, 1.51, 1.45, 1.43, 1.47 kg/d), crude protein (0.25, 0.25, 0.24, 0.22, 0.23 kg/d) and organic matter intakes (1.48, 1.43, 1.36, 1.33, 1.38 kg/d). Crude glycerin decreased ($P < 0.01$) NDF intake (0.29, 0.28, 0.24, 0.22, 0.24 kg/d) and increased ($P < 0.01$) mineral matter intake (0.08, 0.08, 0.09, 0.09, 0.10 kg/d). There was no effect on NDF (55.9, 54.5, 56.3, 56.7, 58.0%) and crude protein digestibilities (82.4, 81.7, 82.8, 81.5, 83.6%), However, DM (83.3, 82.5, 84.2, 85.4, 85.7%) and OM (84.8, 84.0, 85.9, 86.5, 86.8%) digest-

ibilities showed a linear increase ($P < 0.01$). Crude glycerin can replace corn up to 20% of dietary DM increasing DM and OM apparent digestibilities.

Key Words: glycerol, sheep, biodiesel

1915 (M381) Post-weaning performance by intact male F1 Kiko × Boer progeny from does selected based on parasite resistance: 1-yr summary.

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Goats are popular with small landowners and fit into a variety of farming systems. High market prices and continuing parasite challenges have led some producers to consider confinement feeding as a system to improve performance and avoid parasite problems. Therefore, the objective of this study was to evaluate post-weaning performance by intact male F_1 Kiko × Boer progeny from does selected based on parasite resistance. Weaned, intact male F_1 Kiko × Boer progeny ($n = 16$; 10.7 ± 0.59 kg weaning weight; 94.4 ± 2.73 d of age) from two lines of does selected for high resistance to internal parasites (HL; $n = 11$) or for low resistance to internal parasites (LL; $n = 5$) were compared. Animals were confined in a small ruminant barn with full access to a high-concentrate feed ration, water, and mineral supplement. Kid weaning weight, 47-d post-weaning weight, and final weight did not differ ($P \geq 0.19$) across treatments. Weaning to 47 d post weaning ADG, 47 d post-weaning to final ADG, and total ADG did not differ ($P \geq 0.15$) across treatments. Weaning to 47 d post weaning gain, 47 d post-weaning to final gain, and total gain did not differ ($P \geq 0.20$) for HL compared with LL. Therefore, selecting does based on parasite resistance may not influence post-weaning performance of their crossbred male progeny when offered a high-concentrate diet.

Key Words: goats, high-concentrate, parasite resistance

1916 (M382) Effects of thyme oil (*Thymus vulgaris*) on in vitro ruminal fermentation kinetics.

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The objective of the present study was to investigate the effects of dietary thyme oil (1.25, 2.50 and 3.75 mL/kg DM) or monensin (Rumensin; 20 mg/kg DM) on ruminal in vitro gas production kinetics. Diets were formulated using the Small Ruminant Nutrition System to meet the requirements of growing sheep and were 80% Tifton hay (*Cynodon sp.*) and 20% concentrate DM. Homogenized samples of each diet (1.0 g) were placed into 160 mL serum bottles with 10 mL of rumen inoculum and 90 mL of a buffer solution. Rumen inoculum was collected from 4 fistulated male lambs before the first feed of the day was offered. Each lamb was fed one of the four diets, ad libitum. Six bottles were used per treatment and two additional bottles containing buffered medium, rumen fluid and the feed additives were used as background control. The volume of gas produced was indirectly measured at 2, 4, 6, 8, 10, 12, 15, 18, 21, 24, 36, 48, 72, and 96 h of incubation using the pressure reading technique. To estimate kinetic parameters of gas production data were fitted to the model $Y = A \{1- \exp^{[-b(t-L)-c(\sqrt{t}-\sqrt{L})]}\}$, where Y = cumulative gas production (ml) at time t; A = the asymptotic gas production (ml); b and c = constant rates (h^{-1} and $h^{-1/2}$, respectively); t = incubation time (h) and L = lag time (h). Thyme oil additive at 3.75 mL/kg resulted in similar gas production compared to monensin (194.1 ± 3.3; 197.2 ± 1.1 mL, respectively) and in reduced ($P < 0.05$) gas production compared to either 1.25 mL/kg (209.8 ± 0.9 mL) or 2.50 mL/kg (211.0 ± 0.5 mL) of thyme oil. The fractional degradation rate (FDR) was reduced ($P < 0.05$) in the 2.5 and 3.75 mg/ml thyme oil treatments (0.045 ± 0.0007 h) compared to treatment with monensin (0.049 ± 0.0003 h), while the 1.25 mL/kg treatment (0.047 ± 0.0003 h) did not differ from any other treatment. Lag time was reduced ($P < 0.05$) in the monensin (1.16 ± 0.03 h) compared to the 3.75 mL/kg thyme oil treatment (2.26 ± 0.17 h), however no difference was detected among monensin, 1.25 mL/kg (1.66 ± 0.16 h) and 2.50 mL/kg (1.24 ± 0.17 h) of thyme oil. In conclusion, thyme oil may be an effective alternative to monensin for manipulation of rumen fermentation.

Key Words: thyme oil, rumen gases, sheep