

were also able to achieve, at higher usage levels, textural properties similar to several polysaccharide thickeners. Incorporation of spray drying created a more economical process for the production of a whey protein ingredient suitable for contributing viscosity and texture to a wide range of food systems.

Key Words: Whey protein, Cold-gelling, Spray drying

1158 Monthly and regional variation in nitrogen and protein distribution of milk in California manufacturing plants. Phillip Tong* and Sean Vink, *California Polytechnic State University.*

Good information concerning the protein content of milk is useful in discussions of milk pricing, manufacturing yields, and product composition control. The objective of this study was to generate information on the current composition of milk received at California dairy product manufacturing plants.

Thirteen plants from throughout California participated in the study which was undertaken from May, 2000 through April, 2001. Milk samples from all silos of milk received for a given day for a given plant were taken two times per month and blended in proportion to the amount of milk represented by each silo to make a pooled composite monthly sample. Each composite monthly sample was analyzed for total nitrogen,

non-casein nitrogen, and non-protein nitrogen by Kjeldahl methods. Total protein, casein and casein as a percent of total protein were then calculated.

Plant average crude protein (total nitrogen X 6.38) ranged from 3.19% to 3.40%. Plant average true protein ((total nitrogen - non-protein nitrogen) X 6.38), ranged from 3.00% to 3.20%. Casein as a percent of crude or true protein ranged from 76.8% to 77.9%, and 81.6% to 82.7%, respectively. Analysis of monthly variation in milk composition for all plants indicates that protein content was the lowest (approximately 3.2%) in the months of June through August) and the highest (approximately 3.4%) in the months of November through January. Although the number of plants in each region was small, the data indicate that Southern California region has lowest total crude protein and lowest casein as a percent of total protein compared to the other four regions (South San Joaquin Valley, North Central/Sacramento, North Bay Area). Casein as a percent of crude total protein averaged 76.8%, 77.1%, 77.1%, and 77.8% for South San Joaquin Valley, North Central/Sacramento, North Bay Area, respectively.

These results suggest protein content of milks received in California dairy manufacturing plants varied among regions and with time of year.

Key Words: California, milk, protein

Goat Species

1159 Use of 48-hour kid removal to decrease the post-partum rebreeding interval in meat does. C. M. Fletcher*, D. J. Jackson, and N. C. Whitley, *University of Maryland Eastern Shore.*

The objective was to examine the effectiveness of early kid removal in decreasing the post-partum rebreeding interval in goats. Boer and Boer crossbred meat-type does ($n = 25$) and bucks ($n = 4$) were used. Does had kidded in the Fall of the year and were allotted into two groups based on day of lactation and number of nursing kids. All does were housed together in a 67 m x 34 m dry lot pen, fed hay and a corn/soybean meal diet with water ad libitum. Does were injected intramuscularly with 7.5 mg PGF₂ α (Lutalyse, Pharmacia & Upjohn, Kalamazoo, MI; 1.5 cc) on approximately 28.1 \pm 0.8 days of lactation ($d = 0$). At the time of injection, kids from thirteen does (treatment group) were moved to a nearby barn while kids from twelve does (control group) were left with their dams. Kids from does in the treatment group were returned on d 2, while kids nursing does in the control group remained throughout the duration of the experiment. At kid removal, bucks wearing marking harnesses were introduced and remained for 10 days. Females were checked for estrus twice daily and number of animals bred was recorded to determine days to first mating and percentage bred (number bred/number exposed x 100%). In a subset of does (8 control, 11 treated), a milk sample was collected at 47.1 \pm 0.4 days after mating for pregnancy determination using a commercial bovine milk progesterone test (Target Rapid Progesterone Milk Test; BioMetallics, Princeton, NJ). Days to first mating was less ($P < 0.05$) for does whose kids were removed (1.5 \pm 0.4 days) compared to control does (2.8 \pm 0.4 days). In addition, by d 5, the percentage of does bred was greater ($P = 0.053$) for treated does (100 \pm 0.1%) compared to control does (74.6 \pm 0.1%). However, by day 10 of the experiment, all does had been mated. In the does tested, there was no difference in pregnancy rates, and the average was 73.7 \pm 0.1%. In conclusion, early kid removal decreased the post-partum interval, but was not necessary for inducing post-partum mating during the breeding season. However, further studies are needed to determine if pregnancy rates could be increased.

Key Words: postpartum, doe, breeding

1160 Reproductive seasonality in Spanish and Boer x Spanish does in south Texas. M. A. Lerma*¹ and R. L. Stanko^{1,2}, ¹Texas A&M University-Kingsville, Kingsville, TX, ²Texas Agricultural Research Station, Beeville, TX.

Seasonal breeding patterns of goat breeds is a major obstacle to increasing the intensity of meat goat production in temperate regions of the U.S. We conducted two experiments in TX (27° N latitude) to better define meat goat reproductive seasonality. In Exp. 1, Spanish (S,

$n=11$) and Boer x Spanish F₁ (%B, $n=5$) does were monitored for estrous cyclicity over 400 d. Blood samples for progesterone (P₄) determination were obtained weekly, beginning at the vernal equinox (March 21) of Yr 1 through May 3 of Yr 2. Does were kept together in a 2 hectare paddock and had ad libitum access to native forage and sudan hay. Does were group fed daily .45 kg \cdot hd⁻¹ of a commercial pellet (15% CP). Fence line exposure to a fertile buck began on April 26 of Yr 1. Does were anestrus prior to buck exposure. Days from buck exposure to elevated P₄ was similar ($P>0.1$) between S (44 \pm 1) and %B (59 \pm 20) does. A single estrous cycle was exhibited by 15/16 does followed by a summer anestrus period. Length of summer anestrus was similar ($P>0.1$) between S (77 \pm 1 d) and %B (83 \pm 6 d) does. A fertile buck was introduced on Oct. 1 for breeding. A subset ($n=6$) of S does were not exposed to the buck and continued regular estrous cycles until early-Feb. Mean Julian d to onset of anestrus was 40.5 \pm 5.2 and continued throughout the experiment. In Exp. 2, 31 mature, anestrus does of S ($n=21$) and %B ($n=10$) genetics were used to evaluate summer breeding. Weekly blood samples were obtained from June 1 to Oct. 1. Does were allocated to fertile S ($n=2$) or Boer ($n=2$) bucks on June 22. Days from buck exposure to elevated P₄ and level of P₄ were similar ($P>0.1$) between S and %B does. Pregnancy rate (95 % vs. 100%) and % kid crop (200 vs. 210) were similar ($P>0.1$) between S and %B does, respectively. Seasonal anestrus is evident in TX meat goats; however, a male-stimulated, summer breeding season may increase production potential.

Key Words: Goat, Reproduction, Seasonality

1161 A model to test the effect of manipulating photoperiod on the liveweight gain of goats in southern Queensland, Australia. M Flint*¹ and P.J. Murray², ¹School of Veterinary Science, The University of Queensland, St Lucia, Queensland 4072, Australia, ²School of Animal Studies, The University of Queensland, Gatton Campus, Queensland 4343, Australia.

In Australia irrespective of feed intake, goats undergo a period of growth stasis during winter. In feedlots, this results in loss of potential sales of goat meat to overseas markets. In a study using rats as a physiological model for goats, 56 sub adult rats (*Rattus norvegicus*) of the black and white hooded strain (starting weight 68.8 SD 16.8 g) were examined for liveweight gain (LWG) and feed intake over 42 days. The experiment compared combinations of two temperature and two light regimes; mimicking a constant summer temperature (26C) and a constant winter temperature (18C), and a diurnal 'summer' day length (12 hours of light per day) and a diurnal 'winter' day length (6 hours of light per day). With respect to LWG, we found that winter day length (winter day = 5.0 g/d vs summer day = 4.7 g/d LWG; $P = 0.001$) was more influential than winter ambient temperature (winter temperature = 4.9 g/d

vs summer temperature = 4.8 g/d LWG; $P = 0.12$). Greater LWG during the winter light regime may be due to rats being nocturnal feeders, unlike goats which are diurnal feeders. However, a greater efficiency of conversion of feed into LWG occurred under summer temperatures when compared with winter temperatures (3.4:1 and 3.8:1, respectively; $P < 0.05$) whereas day length appeared to have minimal affect (3.5:1 and 3.7:1, respectively; $P > 0.05$). The implications of these findings to goat meat production, particularly when lot feeding, are that artificially extending day light hours during winter may result in liveweight gains equivalent to that experienced during summer but at the cost of a reduced feed conversion efficiency. Extending day light may reduce the effects of growth stasis in goats during winter and allow lot feeding for 42 days prior to slaughter to continue on a year-round basis. These findings remain to be tested using goats in a feedlot.

Key Words: Goat Feedlot, Photoperiod, Rat Model

1162 Effect of sun radiation on plasma cortisol levels in goats under high ambient temperature. R. Rodríguez-Martínez^{*1}, F. Sánchez², R. Bañuelos-Valenzuela³, C. F. Arechiga³, and M. Arenas², ¹Universidad Autónoma Agraria Antonio Narro, U.L. Torreón, Coah., Mexico, ²Universidad Autónoma Metropolitana Xochimilco, D.F. Mexico, ³Universidad Autónoma de Zacatecas, Zacatecas, México.

Two trials were conducted to study the effect of sun radiation exposure under high ambient temperature (over 30°C) on plasma cortisol level in different goat breeds from a flock located in the north of Mexico (2606' NL, 10326' WL, 1092' masl). Samples of blood plasma were obtained at 13:00 and 17:00 h in days 1, 2, 8 and 9, from 15 Alpine and 15 Nubian yearling and non pregnant goats exposed to sun radiation (R) in a paddock without shade, and from the same number of goat and breeds in a paddock with shadow area (S). The trial was repeated the following year, but with two groups of 5 Alpine, 5 Saanen and 5 Granadinas each, and blood sampling in days 1, 2, 3 and 4. Plasma cortisol was determined by RIA. Daily mean cortisol levels per goat and sampling day were calculated and split-plot analysis of variance were conducted separately for each breed within trial. Lower cortisol means ($P < 0.05$) in R vs S goats were observed in Alpine and Saanen breeds. A similar, but non significant ($P > 0.05$) trend was observed in Nubians and Granadinas. These results suggest a different response in cortisol levels among breeds to cope the extra heat load in R groups and a probably greater sensitivity in Alpine origin breeds than in Granadinas and Nubians. Further research on the role of other variables such as corticotropin-releasing hormone (CRH) and CRH-binding protein, or the study of gene expression differences may explain how goats deal with high ambient temperature, and how it affects productive and reproductive performance.

Key Words: Heat stress, Goat breeds, Cortisol response

1163 Blood metabolites, visceral organ mass, meat quality, and calpain system in goats treated with low doses of bovine Somatotropin hormone. B. Kouakou^{*1}, S. Gelaye¹, G. Kannan¹, T. D. Pringle², T. H. Terrill¹, and E. A. Amoah¹, ¹Agricultural Research Station, Fort Valley State University, Fort Valley, GA 31030, ²The University of Georgia, Athens, GA 30602.

Growing female dairy goats ($n = 14$; BW = 24 ± 2.7 kg) were used in a 10-week experiment to assess the effect of daily injection of a low dose (40 $\mu\text{g}/\text{kg}$ of BW) of recombinant bovine somatotropin (rbST) on concentration of blood metabolites, mass of visceral organs, calpain system, and goat meat (chevon) quality. Goats were randomly assigned to either a control (0.9 percent saline; $n = 7$) or a treatment group ($n = 7$) receiving a daily dose of 40 μg of rbST/kg BW. All animals were fed a 16 percent CP and 2.9 Mcal/kg DE alfalfa based-ration *ad libitum*. Blood samples were collected every 2 weeks for 10 weeks and analyzed for glucose, NEFA, and BUN. At the end of the 10-week experiment, animals were sacrificed and processed. A portion of the loin muscle was quickly removed, trimmed of fat, denuded and homogenized in extraction buffer for calpain/calpastatin determination. Components of the viscera were separated and individually weighed. The carcass was chilled for 24 h at 4 ° C and fabricated into loin/rib chops. After instrumental color measurements were made, the chops were vacuum packed and aged for 1, 7 and 13 d at 4 ° C. Before cooking, instrumental color measurements were done after 1 h bloom. Weight loss and shear values were determined on cooked chops. Bi-weekly data (metabolites

and BW) were analyzed as repeated measures. Carcass data were analyzed as a complete randomized design. Weight change, blood glucose and NEFA were not different but BUN was higher ($P \leq 0.05$) in rbST treated (20.9 mg/dL) than in control (14.9 mg/dL). Carcass weight, visceral organ mass, and loin eye area were not affected by rbST injection. Mean m-calpain (46 ± 1.9), μ -calpain (79 ± 2.4) and calpastatin (309 ± 11.1) activities (caseinolytic units per 50 g of tissue) were not affected by rbST injection. Pre-aging instrumental color (L^* , a^* , b^* , chroma and Hue) values were not affected by treatment. Cooking loss was not affected by treatment or treatment by aging interaction. Aging after 24 h chilling tended ($P = 0.09$) to decrease a^* (redness) value. Injection of rbST tended ($P = 0.09$) to decrease shear value. Aging decreased ($P \leq 0.01$) shear value but without significant improvement beyond 7 d. Daily injection of a low dose of rbST does not alter the calpain system in goat meat or modify weight of visceral organs.

Key Words: Goats, Somatotropin, Metabolites, Calpain, Calpastatin, Visceral organs

1164 Serum and milk leptin in does and growth of their offspring. N. C. Whitley^{*1}, S. A. Harley¹, D. J. Jackson¹, E. L. McFadin², and D. H. Keisler², ¹University of Maryland Eastern Shore, ²University of Missouri.

Secreted from both fat and mammary gland tissue, leptin has been found in the milk of a variety of species. It has been hypothesized that milk leptin ingested by offspring early in the postnatal period may influence growth and development of the offspring. However, it has not been determined if leptin is found in goat milk and if milk leptin levels are correlated with the growth of kids. Therefore, the objectives were to determine if goat milk serum contains leptin and to investigate possible correlations of milk and serum leptin in does and subsequent growth of their offspring. To conduct the study, 20 mixed-parity Boer and Boer crossbred meat type does were used. Approximately 5 days prior to kidding a body condition score was assigned and a blood sample was collected via jugular venipuncture. Blood and milk samples were collected within 2 hours of kidding (= d 0) from the does and also on days 0.5, 1, 3, 5, 7, 14, 21, 28, 35, 42, 49, and 56. Body weights of kids were taken at d 0, and body weights of both kids and does were measured weekly beginning on d 7 (kids) or d 21 (does). Blood and milk serum leptin concentrations were determined using radioimmunoassay. Pearson product moment correlation coefficients were obtained to evaluate the relationships between blood serum leptin, milk leptin, doe weight, kid weight, and doe body conditions score. Leptin was detected in milk and averaged 4.3 ± 0.9 ng/ml on d 0 and 1.0 ± 0.2 ng/ml on d 56. Days postpartum and milk serum leptin concentrations were negatively correlated ($r = -.27$; $p < 0.0001$) while days postpartum and blood serum leptin concentrations were positively correlated ($r = .15$; $p < 0.02$). In addition, a negative correlation existed between milk serum leptin concentrations and kid body weight ($r = -.25$; $P < 0.0009$). As expected, positive correlations ($p < 0.0001$) were found between leptin and doe body condition ($r = .42$) and leptin and doe body weight ($r = .44$), as well as for day and kid body weight ($r = .92$). In conclusion, leptin was present in milk and blood serum of does, but they act as independent depots.

Key Words: goat, milk, leptin

1165 Effect of clinical *Staphylococcus aureus* mastitis on early lactation dairy goats. G. M. Tomita^{*1}, S. P. Hart¹, and M. J. Paape², ¹E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK 73050, ²USDA, ARS, ANRI, IDRL, Beltsville, MD 20705.

A study was conducted to characterize the effect of induced *Staphylococcus aureus* mastitis on physical parameters and milk constituents of first lactation Alpine dairy goats in early lactation (22 d in milk). The right udder half of seven goats was challenged with approximately 120 colony-forming units of *S. aureus*. Seven additional goats were not challenged and served as control animals. All goats were free of mastitis at the start of the experiment. Milk samples from each udder half of all goats were collected immediately prior to challenge (0 h) and at 24, 48, and 72 h postchallenge for somatic cell count (SCC) and composition analysis (fat and protein). Rectal temperature and milk yield were also monitored at the time interval above. Acute clinical mastitis occurred within 24 h postchallenge, and clinical symptoms and the infection persisted through 72 h. The logarithm of milk SCC from challenged halves

was higher (6.75, $P < 0.05$, right half) than adjacent halves (6.01, left half) and the SCC of adjacent halves was higher than that of control animals (5.82, $P < 0.05$) at 24 h postchallenge. At 48 h and 72 h, SCC of milk from challenged halves remained elevated (6.86 and 6.96) above those of adjacent halves (5.89 and 5.88, $P < 0.05$) and control animals (5.79 and 5.88, $P < 0.05$). The percentage of milk fat from challenged halves was depressed only at 24 h postchallenge when compared with milk from adjacent halves and control group goats (3.55 versus 3.92 and 4.23, $P < 0.05$). However, the percentage of proteins in milk was higher ($P < 0.05$) in both infected and adjacent halves when compared with milk from control goats at 24 h (3.60 and 3.16 versus 2.76), 48 h (3.86 and 3.54 versus 2.72), and 72 h (3.57 and 3.66 versus 2.66). The rectal temperature of challenged goats peaked at 24 h (40.6 C, $P < 0.05$) and returned to normal values by 48 h and 72 h (39.7 C and 39.2 C). Milk yields of infected goats were depressed at 24 and 48 h postchallenge when compared with control goats ($P < 0.05$) and recovered to prechallenge levels by 72 h. Results indicate that clinical mastitis in one udder half can influence physiological parameters in the adjacent half. Therefore, consideration must be given to both udder halves when evaluating the mammary gland health status of dairy goats.

Key Words: Dairy Goat, Clinical Mastitis, *Staphylococcus aureus*

1166 Prevalence of Coagulase Negative Staphylococci (CNS) and correlation with somatic cell counts in Italian dairy goat herds. P. Moroni¹, M. Antonini², F. Luzi³, D. Cattaneo⁴, G. Savoini⁴, and V. Bronzo¹, ¹Department of Animal Pathology, Hygiene and Veterinary Public Health, ²National Research Centre, ³Animal Husbandry, ⁴Department of Veterinary Sciences for Food Safety.

Intramammary infections (IMI) are among the most serious health and economic problems in dairy goat farming. While clinical cases of mastitis by *S. aureus* are less numerous, more important are the subclinical mastitis due to Coagulase-Negative-Staphylococci (CNS). Five commercial dairies with Alpine lactating goats were studied. Foremilk samples were collected monthly (March to November) for the whole lactation to determine the bacteriology and somatic cell counts (SCC). A total of 4242 milk samples were analysed from 240 lactating goats of various ages. The prevalence of negative samples (NRS) was 65.1% (least square means 825,350 50,653 scc/ml) while IMI caused by CNS was 28.7 % (least square means 1,841,543 79,800 scc/ml) with $P < 0.001$ and by other microorganisms was 6.2% (least square means 2,356,252 38,460 scc/ml). The IMI and SCC of goat milk increased as lactation progressed. In fact, we noticed during the whole lactation an increase of IMI (21.68%-36.84%) simultaneously with a rise in SCC (352,000 cell/ml- 3,137,000 cell/ml).

Key Words: Dairy goat, Coagulase Negative Staphylococci

1167 Morphology of infiltrated neutrophils obtained from goat mammary gland. S. Z. Tian, M. C. Hsu, W. J. Su, and C. J. Chang, *National Chung Hsing University, Taichung, Taiwan.*

Light microscopic morphology of infiltrated polymorphonuclear leukocytes (neutrophils) isolated from mammary secretion of healthy Toggenberg goats during stages of peak lactation, late lactation and the period following drying off were compared with their counterparts in circulation. After staining with Wright Giemsa stain, most neutrophils prepared from blood had an abundance of pink-stained cytoplasmic granules and bilobed nucleus. Infiltrated neutrophils, regardless of the stage of lactation, on the contrary, had multilobed nuclei and granules distributed only in the boundary. Among the three stages of lactation, infiltrated neutrophils from intermittently collected late secretion and dry secretion displayed pyknosis indicative of apoptosis. It is clear from morphology that transmigrated neutrophils are more advanced in stage of cell differentiation than prior to transmigration. Also, apoptosis occurs in aged infiltrated neutrophils with reduced milking frequency. Precaution should be taken in interpreting results if neutrophils from different sources of milk were to be used in study.

Key Words: Polymorphonuclear leukocytes, Mammary secretion, Morphology

1168 Effects of dietary fish oil on colostrum fatty acid profile in dairy goats. D. Cattaneo¹, V. Dell'Orto¹, A. Agazzi¹, V. Moretti¹, P. Moroni², and G. Savoini¹, ¹Dipart. di Scienze e Tecnologie Veterinarie per la Sicurezza Alimentare, Università di Milano, Italy, ²Dipart. di Patologia Animale, Igiene e Sanità Pubblica Veterinaria, Università di Milano, Italy.

Fish oil is a nutraceutical rich in n-3 polyunsaturated fatty acids (n-3 PUFAs), including EPA (C20:5 n-3) and DHA (C22:6 n-3) which are crucial during perinatal growth and development in mammals. Aim of the study was to determine the composition and the fatty acid profile of colostrum as influenced by feeding fish oil to periparturient dairy goats. From ten days before expected day of kidding, 14 pregnant Saanen dairy goats were fed either a control diet (C) or a diet supplemented with 27 g/d cod liver oil (COD). The supplement contained 9.8% EPA and 13.6% DHA. Colostrum was sampled within the first 24 hours post partum. There were no significant effects of treatments on colostrum percentages of fat (5.63 and 5.08 %), protein (11.59 and 14.54 %), lactose (2.33 and 2.16 %) and on somatic cell count (3.38 and 2.98 %, respectively for C and COD). Dietary fish oil altered colostrum fatty acid profile, increasing the proportion of C16:1 (3.57 vs. 1.89%, $P < 0.01$) and lowering the concentrations of C18:0 (5.26 vs. 9.31%, $P < 0.01$), C18:2 (4.12 vs. 6.14%, $P < 0.01$) and C18:3 (0.78 vs. 1.12%, $P < 0.05$). Fish oil addition increased the concentration of long chain (\geq C20) n-3 PUFAs (1.56 vs. 0.64%; $P < 0.01$), including DHA (0.71 vs. 0.33%, $P < 0.01$) and EPA (0.84 vs. 0.43%, $P < 0.05$). Results indicate that feeding fish oil to periparturient dairy goats can increase concentration of long chain n-3 PUFAs in colostrum fat.

Key Words: Goat colostrum composition, Fish oil, n-3 PUFA

1169 Effects of the administration of fish oil on immune system in periparturient goats. G. Savoini¹, A. Agazzi¹, D. Cattaneo¹, P. Moroni¹, L. Bonizzi², D. Pasotto², and V. Bronzo¹, ¹University of Milan, Italy, ²University of Padua, Italy.

Fish oil is a nutraceutical rich in n-3 fatty acids which beneficially influence the immune system. Aim of the study was to evaluate the effects of dietary fish oil during the peripartum on aspecific immune response and cell-mediated immunity of dairy goats. Ten days before kidding, 27 Saanen dairy goats were divided into 3 groups on the basis of parity: C=control, T1= unprotected fish oil (UFO), and T2= rumen protected fish oil (PFO). All goats received the same basal diet. Starting 10d before kidding and continuing until parturition T1 and T2 goats received 27g/d UFO and 55g/d PFO respectively. From kidding until 15d postpartum T1 and T2 groups received 45g/d UFO, and 90g/d PFO respectively. Goats were skin tested on day 4 before and 4, and 15 days after parturition. Aspecific immune response was evaluated by determining the increases in double skinfold thickness at 0, 8, 16 and 24h after the injection of 250 μ g phytohaemagglutinin (PHA). Blood samples were collected at 10 and, 4d before and 4 and, 15d after kidding, and subsequently analyzed for leukocytes count and formula, and lysozyme. Data were analyzed by the GLM procedure of SAS. Skin test at 4d before and 15d after kidding was not statistically different among groups. Greater responses were observed in UFO vs C group at 8, 16 and 24h after injection at 4d after parturition (respectively 1.8 vs 0.97 mm, $P < 0.05$; 2.78 vs 1.31 mm, $P < 0.05$; 3.48 vs 1.02 mm, $P < 0.01$), and in PFO vs C at 24h after injection (2.37 vs 1.02 mm, $P < 0.05$). Treatments did not affect leukocytes count, basophils, eosinophils, and monocytes content while lymphocytes content was significantly higher on day 4 after calving for UFO vs C ($P < 0.05$). Lysozyme content was significantly lower in UFO vs C ($P < 0.001$) indicating a minor activity of monocyte cells. The administration of fish oil showed positive effects on aspecific immune response in dairy goats during the transition period.

Key Words: goats, fish oil, immune response.

1170 Physiological responses, immune function, and live weight shrinkage due to simulated preslaughter stress in goats fed a diet (Tasco) containing seaweed extract. G. Kannan*¹, T. H. Terrill¹, B. Kouakou¹, S. Galipalli¹, K. E. Saker², R. A. Kircher¹, S. Gelaye¹, and K. M. Gadiyaram¹, ¹Agricultural Research Station, Fort Valley State University, Fort Valley, GA, ²Virginia-Maryland Regional College of Veterinary Medicine, Blacksburg, VA.

Tasco feed is an *Ascophyllum nodosum* seaweed-containing product that has increased antioxidant activity in animals, but its effect on goats has not been tested. Mature female Spanish (S) and Boer x Spanish (BS) goats (average weight 39 kg, n = 20/Breed) were housed in pens (5 does/pen), and fed an alfalfa pellet diet plus a Tasco pellet supplement either with or without seaweed extract (Treatment) for three weeks. The Tasco feed supplement was given at 2% of daily intake. The animals were subjected to a 6-h transportation on two days (Replicate) to impose stress (20 does/Replicate) and then held overnight without feed in pens to simulate preslaughter conditions. The animals were weighed immediately before and after transport, as well as after holding to assess live weight losses. Blood samples were collected at 0, 2, and 6 h of transportation, and after holding (24 h) to assess stress responses and monocyte phagocytic activity (Time). Shrinkage was greater in BS than in S goats due to transportation ($P < 0.05$) and transportation plus holding ($P < 0.01$). Treatment did not influence plasma cortisol, urea nitrogen (PUN), nonesterified fatty acid (NEFA) concentrations and creatine kinase (CK) activity. Plasma glucose concentrations were influenced by Treatment x Breed x Time ($P < 0.01$) interaction effect. Plasma cortisol increased due to transportation, but decreased after holding ($P < 0.01$). Plasma CK activity also increased due to transportation and peaked at 6 h, but decreased after holding ($P < 0.01$). The PUN concentrations decreased with transportation time in both breeds, but increased significantly at 24 h only in S goats (Breed x Time, $P < 0.01$). There was a more rapid increase in NEFA concentrations due to Time in the S compared to BS goats (Breed x Time, $P < 0.01$). Neutrophil (N), lymphocyte (L), and monocyte counts and N/L ratio were not influenced by Treatment. However, seaweed extract supplementation decreased eosinophil counts ($P < 0.05$). Seaweed extract also decreased lipid peroxidation of cells, particularly after the onset of stress. The results suggest that live weight shrinkage and stress responses significantly differ in different breeds of goats. Tasco seaweed extract supplementation may be beneficial to goats because of its antioxidant activity.

Key Words: Goats, Preslaughter stress, Immune response, Shrinkage

1171 Adjustment factors for fat, protein, and somatic cell count for goat milk using different species-specific calibration standards. T.A. Gipson*¹ and T. McKinney¹, ¹E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK.

Currently, test-day samples of dairy goat milk are analyzed for fat, protein, and somatic cell count with laboratory equipment calibrated for cow milk, even though research has demonstrated that these measures are biased. The objective of this research was to examine breed, parity, and stage of lactation effects on this bias and to develop appropriate adjustment factors. Langston Dairy Herd Improvement (DHI) laboratory equipment was calibrated using both cow and goat milk standards. During 2001, 3,110 test-day samples from 875 does of six different breeds and 84 herds were analyzed for milk fat, protein, and somatic cell count with both calibrations. Of the 875 doe records, 373 were first parity, 181 second parity, 140 third parity, and 174 fourth or greater parity; and 196 were Alpine, 161 LaMancha, 284 Nubian, 45 Oberhasli, 124 Saanen, and 65 Toggenburg. Lactation was divided into 6 stages of 50 days according to days in milk (DIM). Differences (DIFF) in standards (cow vs goat) were analyzed as a repeated measures design using mixed model analysis. The statistical model included doe identity, breed, parity and stage of lactation with doe identity nested within breed as a random effect. There was no effect ($P > 0.10$) of breed or parity, on DIFF for fat, protein or somatic cell count. Stage of lactation affected ($P < 0.01$) DIFF for protein but not for fat or somatic cell count. Test-day samples analyzed with goat standards were regressed on test-day samples analyzed with cow standards to obtain adjustment factors. Multiplicative adjustment factors (cow standards adjusted to goat standards) were 1.027 for fat ($R^2 = 0.85$), 1.164 for protein with DIM less than or equal to 100 d ($R^2 = 0.94$), 1.125 for protein with DIM greater than 100 d ($R^2 = 0.99$), and 0.937 for somatic cell count ($R^2 = 0.96$). It appears that the bias

in goat test-day samples analyzed under conventional DHI laboratory procedures can easily be alleviated using simple adjustment factors.

Key Words: Goat, Adjustment factors, Milk

1172 Metabolizable protein requirements of lactating goats. I. V. Nsahlai*^{1,2}, A. L. Goetsch¹, J. Luo¹, and T. Sahl¹, ¹E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK, ²Department of Animal and Poultry Science, University of Natal, Scottsville, R. South Africa.

Data from 31 studies with 174 treatment mean observations from goats in different stages of lactation were used to determine the metabolizable protein (MP) requirement for lactation (MP_l). Milk protein yield (MkP) was calculated from milk yield and protein concentration. The MP supply, the sum of digestible ruminally undegraded dietary and microbial true protein, was estimated from ingredient composition and a database of CP degradability properties and ruminal fermentable energy concentration derived from literature values when not provided in the original publication. MP_l was estimated from MP by subtracting MP used for maintenance functions (scurf (g CP), $0.2 \times \text{kg BW}^{0.6}$; endogenous urinary (g CP), $1.031 \times \text{kg BW}^{0.75}$; metabolic fecal (CP), 2.67% DM intake; 67% efficiency of use) and adjusting for BW change (14.3% protein). MP_l was regressed against MkP, and after removing observations with residuals greater than 1.5 times the residual SD, the refitted equation was: $\text{MP}_l = 10.2 (\text{SE} = 8.13) + 1.18 (\text{SE} = 0.095) \times \text{MkP}$ (n = 149, adjusted $R^2 = 0.51$); the intercept was not different from zero ($P > 0.05$). Based on a no-intercept equation, 1.30 (SE = 0.034) g of MP_l were required for 1 g of MkP, corresponding to milk protein efficiency of 0.77. In conclusion, these results suggest an MP_l requirement for goats of 1.30 g/g of MkP. Although this approach and estimate of the MP_l requirement should have utility in expressing needs for protein and/or predicting milk production by lactating goats, improvements in accuracy from refined assumptions are desirable and will likely occur with future research. Supported by USDA project No. 9803092.

Key Words: Goats, Lactation, Protein

1173 Effect of ruminally degraded nitrogen source and level in a high concentrate diet on site of digestion in Boer # Spanish wethers. S. A. Soto-Navarro*, A. L. Goetsch, T. Sahl, R. Puchala, and L.J. Dawson, E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK 73050.

Eight yearling Boer # Spanish goat wethers (35.3 ± 6.6 kg average initial BW) with ruminal and duodenal cannulas were used in an experiment with two simultaneous 4 # 4 Latin squares to study effects of supplemental ruminally degraded N (DIP) source and level on sites of digestion. Diets were (DM basis) 9.2% CP, without inclusion of urea (U0) or soybean meal (S0); 11.3% CP achieved with 0.73% urea (U1) or 4.48% soybean meal (SBM; S1); 13.3% CP via use of 1.46% urea (U2) or 8.90% SBM (S2); or 15.2% CP derived through use of 2.16% urea (U3) or 13.2% SBM (S3). The ratio of DIP:TDN was 0.073, 0.104, 0.136, 0.167, 0.073, 0.093, 0.113, and 0.132 for U0, U1, U2, U3, S0, S1, S2, and S3, respectively. Microbial OM and N flows to the duodenum linearly decreased as ($P < 0.05$) CP level increased (N: 8.8, 7.6, 7.8, 6.7, 7.4, 6.0, 6.7, and 6.7 g/d for U0, U1, U2, U3, S0, S1, S2, and S3, respectively). Apparent ruminal OM digestibility increased linearly as CP level increased, and there was an interaction between the quadratic effect of CP level and source in total tract OM digestibility ($P < 0.05$). With urea diets, total tract OM digestibility plateaued at U1, while the peak with SBM was at S2 (71.3, 78.0, 77.7, 77.8, 71.5, 73.1, 74.7, and 75.0% for U0, U1, U2, U3, S0, S1, S2, and S3, respectively; SE = 0.14). There were interactions between linear and quadratic effects of CP level and source in true ruminal and postruminal N digestibilities ($P \leq 0.08$). With urea diets, true ruminal N digestibility linearly increased and postruminal N digestibility linearly decreased as CP level rose, whereas there were marked effects of SBM inclusion but no differences among S1, S2, and S3. Ruminal and total tract NDF digestibilities (total tract: 51.3, 57.6, 57.7, 57.4, 49.7, 52.3, 53.2, and 53.2% for U0, U1, U2, U3, S0, S1, S2, and S3, respectively) increased linearly ($P < 0.05$) with increasing CP level, although differences tended to be greater for urea or SBM inclusion than among U1, U2, and U3 or S1, S2, and S3 (quadratic, $P \leq 0.13$). N recycling in yearling goats appears adequate to support high microbial growth with a high concentrate diet, although OM and NDF

digestion may be enhanced by additional DIP for a DIP:TDN ratio of 0.10 to 0.11. Supported by USDA project No. 98-38814-6240.

Key Words: Goats, Ruminally degraded N, Soybean meal, Urea

1174 A comparison of two heart rate monitoring systems for goats. R. Puchala*, I. Tovar Luna, A. L. Goetsch, T. Sahu, and J. Luo, *E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK.*

Heart rate (HR) holds promise as an indirect means of estimating energy expenditure by ruminants. Therefore, two monitoring systems were compared with different goat breeds, diets, and levels of intake. The CP-402 stationary biosignal preamplifier method (BA) of Sable Systems (Henderson, NV) was compared with the human S610 monitor (HM) of Polar (Woodbury, NY). Electrode signals for BA were adjusted and filtered, with less dependence on signal quality relative to HM, whereas measurement with HM was more frequent (1- vs 10.5-min intervals). Heart rate was measured over 48-h periods while goats consumed alfalfa hay or a high concentrate diet for BW maintenance and on d 3 and 4 of fasting. Six Spanish (36 ± 1.3 kg), 7/8 Boer (39 ± 4.4 kg), Angora (23 ± 4.0 kg), and Alpine (41 ± 6.3 kg) wethers, > 1.5 yr of age, were employed. Stick-on ECG electrodes, used for both methods, were attached to the chest just behind and slightly below the left elbow and at the base of the jugular groove on the right side of the neck. Overall HR means were similar between methods (50.5 ± 11.75 and 50.1 ± 11.81 for BA and HM, respectively). Intercepts and slopes of equations for regressions of mean observations (2-day measurement periods) with BA against those with HM were similar among breeds and between diets and levels of intake. Therefore, all observations for BA were regressed against those for HM: BA HR = 1.784 (SE = 1.626) + 0.972 (SE = 0.032) \times HM HR (SE = 0.032) ($n = 48$; $R^2 = 0.954$). Because the intercept was not different from zero, a final no-intercept regression was fitted: BA HR = 1.005 (SE = 0.007) \times HM HR ($n = 48$; $R^2 = 0.998$), with the slope not different from one. In conclusion, BA and HM appear equally effective for measuring HR of goats in confinement, but the small size and light weight of HM may be conducive to use with grazing goats. Supported by USDA project No. 0003835.

Key Words: Goats, Heart rate, Energy expenditure

1175 Effects of ad libitum consumption of concentrate and forage offered separately or mixed on growth of Alpine Doelings. A. L. Goetsch*, G. Detweiler, J. Hayes, R. Puchala, and T. Sahu, *E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK.*

Forty-four weaned Alpine doelings (16 ± 0.19 kg initial BW) were used in a 16-wk experiment to determine how separate free-choice offering of concentrate (C) and forage (F; wheat hay, 14.2% CP and 34.1% ADF) affect performance compared with consumption of mixed diets of different proportions of C and F. Treatments (two groups/treatment) were A-25C: 25% C mixed diet consumed ad libitum; A-50C: 50% C mixed diet consumed ad libitum; A-75C: 75% C mixed diet consumed ad libitum; A-C:A-F: ad libitum consumption of C and F, offered separately; and L-C:A-F: restricted intake of C (approximately 1.5% BW) and ad libitum intake of F. Orts averaged 6.7–0.58% of diet offered. Intake of DM was similar among treatments (625, 641, 623, 704, and 653 g/d; SE = 38.6); dietary concentrate was 26, 53, 80, 84, and 61% of DM intake for A-25C, A-50C, A-75C, A-C:A-F, and L-C:A-F, respectively; SE = 1.51). Average daily gain was greatest ($P < 0.05$) for A-C:A-F and lowest ($P < 0.05$) for A-25C (53, 71, 81, 105, and 73 g; SE = 5.2), and ADG:DM intake ranked ($P < 0.05$) A-25C < A-50C and L-C:A-F < A-75C < A-C:A-F (85, 110, 130, 149, and 111 g/kg for A-25C, A-50C, A-75C, A-C:A-F, and L-C:A-F, respectively; SE = 5.2). In conclusion, separate free-choice offering of C and F for Alpine doelings appears promising as a simple means of achieving high ADG and efficient feed utilization, and restricted offering of C with separate free access to F can yield ADG and ADG:DM intake similar to ad libitum consumption of a mixed diet providing a comparable dietary concentrate level.

Key Words: Goat, Growth, Diet

1176 Effects of method of offering broiler litter and level of prairie hay intake on growth of Boer \times Spanish wethers. Y. Mekasha, R. C. Merkel, A. L. Goetsch, T. Sahu*, and K. Tesfai, *E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK.*

Thirty-four Boer \times Spanish wethers (18 ± 0.3 kg initial BW) were used in a 12-wk experiment ($2 \times 2 + 1$ factorial arrangement of treatments) to determine effects of ad libitum consumption of broiler litter (B) alone or mixed with corn (60% B; BC) and of ad libitum vs restricted prairie hay (H) intake on feed intake and growth performance. Treatments were ad libitum H + an average of 22 g/d of mineral/vitamin supplement (Control, C); ad libitum H and B (AH-B); ad libitum H and BC (AH-BC); intake of 1% BW (DM) of H + ad libitum B (RH-B); and 1% BW of H + ad libitum BC (RH-BC). Hay DM intake averaged 494, 442, 336, 175, and 160 g/d (SE = 16.7), and total DM intake was 516, 700, 782, 474, and 585 g/d (SE = 26.2) for C, AH-B, AH-BC, RH-B, and RH-BC, respectively. Overall ADG ranked ($P < 0.05$) AH-BC > AH-B and RH-BC > C and RH-B (-6, 34, 79, 3, and 50 g); the ratio of ADG:DM intake ranked ($P < 0.05$) AH-BC and RH-BC > AH-B > C and RH-B (-13, 49, 97, 5, and 85 g/kg) for C, AH-B, AH-BC, RH-B, and RH-BC, respectively. In summary, offering B alone free-choice increased ADG by Boer cross goats when consuming H ad libitum but not with H intake restricted to 1% BW. The lower ADG:DM intake ratio for AH-B vs RH-BC indicates less efficient utilization of H than corn, although similar ADG reflects compensation via greater H intake. Mixing corn with B increased ADG similarly with both ad libitum and restricted H intake. In conclusion, depending on production goals and availability of high-quality feedstuffs such as cereal grains, free-choice consumption of B may be a simple and useful method of supplementing low-quality forage.

Key Words: Goats, Broiler litter

1177 Poultry litter pellets in meat goat diets. D. J. Jackson*¹, B. J. Rude², K. K. Karanja¹, D. M. Ferrara¹, and N. C. Whitley¹, ¹University of Maryland Eastern Shore, ²Mississippi State University.

Female and male crossbred meat goats were used in two experiments to determine if poultry litter pellets could be used as a protein source in the diets of growing meat goats. In Experiment 1 (Exp 1), thirty-eight animals approximately 66.5 \pm 0.7 days of age and 14.2 \pm 0.3 kg body weight were fed 18% CP diets with 0 (CON; corn/soybean diet with alfalfa pellets; $n = 13$), 20 (20PL; 20% poultry litter pellets, 80% CON; $n = 12$) or 40% poultry litter (40PL; 40% poultry litter pellets and 60% CON; $n = 13$). In Experiment 2 (Exp 2), ten males contemporary to those in Exp 1 fed CON or 40PL ($n=5$ per diet) were used in 2 metabolism trials at 93.7 \pm 0.9 and 121.7 \pm 0.9 days of age (Trials 1 and 2, respectively). All goats were weaned into 2.4 m \times 2.4 m pens with slatted concrete floors and allowed ad libitum access to feed and water. Goats were allowed a 23-d adjustment period during which their diets were gradually increased to 100% treatment diet ($d=0$). In Exp 1, goat body weights and feed intake were measured every 7 d for 42 d. In Exp 2, animals were placed in metabolism pens and after a 3-d adjustment period, feed intake and fecal and urine output were measured and samples collected daily for 7 d to determine diet digestibility. In Exp 1, average daily gain (54.3 \pm 17.1 g) and feed efficiency (35.9 \pm 11.5 g kg⁻¹) were not influenced by diet. In Exp 2, organic matter (80 \pm 1% for Trial 1 and 63 \pm 2% for Trial 2) and CP (70 \pm 3% for Trial 1 and 75 \pm 7% for Trial 2) digestibility were similar for diets in both Trials. DM digestibility was greater ($p < 0.03$) for CON (81 \pm 1% and 82 \pm 1% for Trial 1 and 2, respectively) when compared to 40PL (77 \pm 1% and 75 \pm 1% for Trial 1 and 2, respectively). ADF (41 \pm 4% for CON and 67 \pm 4% for 40PL) and NDF (48 \pm 4% for CON and 71 \pm 4% for 40PL) digestibility were greater ($p < 0.01$) for 40PL compared to CON diet in Trial 1 only. Gross energy was higher ($p < 0.04$) for 40PL compared to CON in Trial 2 only (83 \pm 0.3% and 82 \pm 0.3%, respectively). In conclusion, poultry litter is an adequate source of digestible protein and can be fed short-term to growing meat goats.

Key Words: poultry litter, goat, digestibility

1178 Effect of high dietary copper on growth performance and carcass characteristics in goat kids. Carla Hopkins* and Sandra Solaiman, *Tuskegee University*.

An experiment was conducted to determine the effect of high dietary Cu on growth performance and carcass characteristics in goat kids. Fifteen Spanish x Boer goat kids (BW 21.3 ± 0.7 kg) were housed in individual pens and were randomly assigned to three different treatment diets. Treatments consisted of: 1) control (no additional supplemental Cu); 2) 100 mg Cu/d (100Cu) from Cu sulfate (CuSO₄); and 3) 200 mg Cu (200Cu) from CuSO₄. Copper was placed in gelatin capsules and inserted in the esophagus with balling gun before morning feeding. Animals were fed *ad libitum* twice a day a 70:30 grain: hay, to meet daily requirements of growing kids according to the NRC (1981). Feed intake and refusals were monitored daily and intake was adjusted weekly for 14 wk. Body weight was recorded after 4 h withdrawals from water, for two consecutive days at 2-wk intervals for 14 wk. After 14 wk, animals were slaughtered, carcass hot weight (HW), carcass chill weight (CW), dressing percentage (DP), kidney and pelvic fat (KPF), longissimus muscle area (LMA), back fat and other carcass parameters were measured. Average daily gain over 14 wk was improved by 100 mg supplemental Cu intake (Q, $P = 0.05$). No difference in ADG was observed in kids for first and last 4 wk of Cu supplementation. Average daily feed intake was similar ($P > 0.05$) between animals, however, control group consumed higher concentrate: hay ratio in the diet (L, $P = 0.01$). Gain efficiency tended to be lower ($P = 0.07$) with 200Cu group when compared to 100Cu. No differences ($P > 0.05$) were observed in HW and CW, however, DP tended to be lower ($P = 0.08$) for 200Cu when compared to others. No difference ($P > 0.05$) in KPF was observed, however, body wall fat (L, $P = 0.07$), fat over 9th rib (L, $P = 0.01$) and adjusted fat thickness (L, $P = 0.03$) decreased as Cu supplementation increased. No differences ($P > 0.05$) in LMA were observed, however, percent boneless closely trimmed retail cuts improved (L, $P = 0.04$) as Cu supplementation increased. Copper supplementation at 100 mg Cu/d improved gain and decreased carcass adjusted fat thickness, however, higher Cu supplementation (200 mg/d) was not beneficial.

Key Words: Cu supplementation, ADG, Goat kids

1179 Effect of two types of multinutrient blocks on kids browsing during the dry season. A. Boubaker* and C. Kayouli, *Institut National Agronomique de Tunis*.

The objective was to determine the effect of two types of multinutrient blocks supplementation on growth kids browsing during the dry season in a subhumid region of Tunisia. Twenty one kids were divided into three equal groups. Control group was allowed to graze without any supplementation whereas the others 2 groups were supplemented with either block B1 or B2 in the barn at night. Blocks were mainly made of wheat bran (54 %), molasses (10%), urea (5%), minerals (5%) and without (B1) or with 15 % of PEG(B2). The body weight of kids was recorded every three weeks. Statistical differences ($P < .05$) in kids growth were found between control and supplemented groups. During the first two months, control group lost ($P < .005$) more weight (-21%) than supplemented groups (-6%). The final body weight tended to be higher for B2 than B1. This study showed that feed blocks might be used to maintain kids browsing during the dry season. Further studies are needed to determine the conditions for better use of PEG in blocks.

Key Words: kids, browsing, blocks

1180 Variation in browse nutrient content in western Oklahoma throughout the growing season. R. C. Merkel*¹, A. L. Goetsch¹, M. Moseley², R. Blackwell³, and T. Curtis⁴, ¹*E (Kika) de la Garza Institute for Goat Research, Langston University, Langston, OK*, ²*USDA, NRCS, Stillwater, OK*, ³*U.S. Forest Service, USDA/Black Kettle National Grassland, Cheyenne, OK*, ⁴*USDA, NRCS, Taloga, OK*.

Leaves of browse species were sampled from May to September in west central (WC) and western OK (W) to determine changes in chemical composition throughout a growing season. Shinnery oak (SH, *Quercus havardi*) and sumac (SU, *Rhus copallina*) were sampled at each site. Blackjack oak (BK, *Q. marilandica*) and post oak (PK, *Q. stellata*) were sampled in WC and locust (LC, *Gleditsia triacanthos*), sand plum (SP, *Prunus angustifolia*), and skunkbush (SK, *R. aromatica*) in W. Sites were divided into three areas for sampling with three replications taken

of each species in each area, frozen, and freeze dried. Samples were analyzed for DM, ash, N, NDF, ADF, ADL, and true IVDMD (NDF as end-point measure). The DM percentage tended to increase throughout the growing season ($P < 0.01$). There was a species by date interaction ($S \times D$) in ash concentration ($P < 0.01$), with level increasing through mid-summer and then stabilizing or declining slightly. There was no difference in N level among WC species ($P > 0.05$), and N level was lowest in August ($S \times D$; $P < 0.01$). In W, LC had higher N ($P < 0.01$) compared with other species. In WC, oak species had higher NDF, ADF, and ADL throughout the growing season compared with SU ($P < 0.05$), while in W NDF concentrations ranked SH > LC > SU, SK, and SP ($P < 0.05$). NDF in WC was highest in July and decreased thereafter, whereas in W, NDF concentration tended to increase throughout the growing season ($S \times D$; $P < 0.01$). IVDMD of oak species in WC was lower ($P < 0.05$) than in SU throughout the collection period. Exceptionally high IVDMD, over 90%, was recorded for SU in both WC and W. Trends in nutrient content found over a 5-month sampling period indicate that, in general, tree leaves decrease in N concentration and increase in fiber and lignin contents.

Key Words: Browse, Nutrient content, Growing season

1181 Rumen fermentation parameters in goats fed on a thorn scrubland in North Mexico. G. C. Nevarez¹, M.A. Cerrillo¹, and R.A.S. Juarez*, *Universidad Juarez del Estado de Durango, Durango, Dgo. Mexico*.

Three rumen cannulated grazing goats (38 ± 1.7 Kg BW) fed on a thorn scrubland were used to estimate ruminal VFA and ammonia nitrogen concentrations. Rumen fluid samples were collected once a month at 0, 2, 4, 6, 8 and 10 hours after grazing started for a period of 12 months. Two seasons were considered; dry season from January to June and rainy season from July to December. Data were analyzed using a randomized block design with a split plot in time. Total VFA concentrations were affected by time of sampling ($P < .05$), the highest concentration was registered 8 h after grazing. Mean total VFA concentration was 51.1 mMol/l. Molar concentration of acetate was lower ($P < .05$) for the dry (58.1) than for the rainy season (61.5), whereas the propionate was higher for the dry than for the rainy season (26.8 vs 24.1 respectively). No differences were observed in butyrate among seasons (10.2 and 9.4 for dry and rainy seasons respectively) ($P > .05$). Differences were observed in the A:P ratio (2.3 and 2.6 for the dry and rainy season, respectively). The mean concentrations of NH₃-N during the dry season were 4.8 mg/100 ml and 9.7 mg/100 ml of rumen fluid the rest of the year. The latter being superior to the recommended for maximum microbial efficiency. It is concluded that the total concentrations of VFA are lower than normal for high roughage diets. The concentrations of NH₃-N during the dry season may limit rumen microbial growth.

Key Words: Goats, Volatile fatty acids, Grazing

1182 In vitro gas production in diets consumed by grazing goats in a semiarid region of North Mexico. O.O. Lopez¹, C.G. Nevarez¹, R.A.S. Juarez¹, and M.A. Cerrillo*¹, *Universidad Juarez del Estado de Durango, Durango, Dgo. Mexico*.

The objective of the present study was to determine the *in vitro* gas production of the diet consumed by grazing goats. Samples from the diet were obtained from three esophageal cannulated goats belonging to a herd of 300 animals. The sampling was performed for two days each month, in the morning and evening during the years 1999 and 2000. The samples (200 mg DM) were incubated in glass syringes using rumen fluid from three goats fed alfalfa hay. The gas volumes were recorded at 0, 3, 6, 9, 12, 24, 48 and 96 h after incubation. The kinetics of gas production were derived from the volumen recordings described by the exponential equation $y = a + b(1 - e^{-ct})$. Data were analyzed by ANOVA according to a randomized block design. Statistical differences were registered ($P > .05$) for the c fraction between the 1999 dry and rainy season. For the year 2000 statistical differences were observed for the fractions b, a + b, c and EP (effective production). Results from this study indicate that the *in vitro* gas production kinetics obtained during the dry season may reflect a lesser nutritive value compared to the forage consumed for goats in the wet season.

Year	Season	b	a+b	c	EP
1999	Dry	38.2 ^a	39.9 ^a	0.048 ^b	25.2 ^a
	Wet	43.4 ^a	43.5 ^a	0.071 ^a	30.5 ^a
2000	Dry	33.0 ^b	30.9 ^b	0.049 ^b	18.4 ^b
	Wet	40.9 ^a	40.4 ^a	0.066 ^a	27.6 ^a

EP= Effective gas production; means within a row with same superscript do not differ (P<0.05)

Key Words: goats, gas production, grazing

Horse Species

1183 Effects of feeding a blend of grains naturally-contaminated with *Fusarium* mycotoxins in feed intake, serum chemistry and hematology of horses. S.L. Raymond*¹, T.K. Smith², and H.V.L.N. Swamy², ¹Equine Research Centre, University of Guelph, ²University of Guelph.

A study was conducted to determine the effect of feeding mature horses a blend of grains naturally-contaminated with *Fusarium* mycotoxins. Changes in feed intake and metabolism and the efficacy of a yeast cell wall polymer mycotoxin adsorbent were determined. Nine non-exercising, mature mares were randomly assigned to one of three experimental diets for 21 days (d). The experiment was subsequently replicated in time. Diets included: (1) control, (2) blend of contaminated grains (10 ppm deoxynivalenol, DON) and (3) blend of contaminated grains + 0.2% yeast cell wall polymer (MTB-100, Alltech Inc.). All diets included 35% grain + 65% forage. Feeding of contaminated grains to horses resulted in reduced feed intake compared to controls (p<0.05). Supplementation of the yeast cell wall polymer to the blend of contaminated grains significantly improved feed intake compared to the feeding of contaminated grains. Consumption of forage remained unaffected regardless of diet fed. Gamma-glutamyltransferase levels were significantly higher in serum of horses consuming contaminated grain on days 7 and 14 but not on day 21 implying that the horses might be adapting to the hepatotoxicity caused by the mixture of *Fusarium* mycotoxins. It was concluded that the feeding of grains naturally-contaminated with *Fusarium* mycotoxins can decrease feed intake and alter serum chemistry in mature horses. Supplementation of yeast cell wall polymer to contaminated grains was beneficial in alleviating reduced feed intake in mature horses.

Key Words: Equine, *Fusarium*, Deoxynivalenol

1184 Serum vitamin E and trace minerals levels and blood parameters in growing throughbred horses during the period of pasture grazing and the stable feeding. C. E. Lee*¹, N. K. Park¹, S. B. Ko¹, S. H. Jin¹, D. H. Kang², and K. I. Kim³, ¹National Jeju Agri. Exp. Station, Jeju, Rep. of Korea, ²Korea Racing Association, Jeju, Rep. of Korea, ³Cheju National University, Jeju, Rep. of Korea.

Nutritional adequacy of growing horses raised in an alternate feeding system - grazing during late spring through early fall and stable feeding for the rest season - was assessed by determining vitamin E and mineral levels in serum, and various blood parameters related to nutrition and health. During the stable feeding, 50 growing female horses were fed concentrates (1.4% of their body weight), grass hay (0.62%) and alfalfa hay (0.37%). During the grazing, the same horses were fed supplementary concentrates (1.1%). Blood samples were taken the day before (average BW, 321 kg at the age of 11 to 14 mo) and 45 d after the start of grazing (355 kg). Serum vitamin E increased (P < 0.01) during grazing compared to that found before the initiation of grazing (1.35 vs 0.96 mg/L). Serum Fe, Cu and Zn contents were much lower (P < 0.01) during than before grazing. Blood urea (25.2 vs 31.2 mg/100 mL), GOT (378 vs 407 IU/L), GTP (7.0 vs 9.7 IU/L), T-bilirubin (0.35 vs 0.46 mg/100 mL) and D-bilirubin (0.14 vs 0.18) levels were much higher (P < 0.01) during than before grazing. Blood glucose (120 vs 91 mg/100 mL), creatinine (1.4 vs 1.2) and Ca (14.9 vs 12.9) levels were lower (P < 0.01) during than before grazing. Results indicate that general nutrition in these horses is adequate during both the pasture grazing and stable feeding periods, although vitamin E and some trace minerals in the serum vary with feeding system.

Key Words: Horses, Feeding system, Vitamin E

1185 Pilot study investigating the potential of ginseng (*Panax quinquefolium*) to potentiate routine vaccination in horses. W. O'Neill*¹, J. T. Arnason², S. McKee³, and A. F. Clarke⁴, ¹Nutraceutical Alliance Inc., Guelph, Ontario, Canada, ²University of Ottawa, Ottawa, Ontario, Canada, ³Equine Research Centre, Guelph, Ontario, Canada, ⁴University of Melbourne, Melbourne, Australia.

This paper reports a pilot investigation into the potential for using ginseng to potentiate routine vaccination in healthy horses. Ten horses with known vaccination history were included in the randomized, placebo-controlled, double-blind trial. Five horses received ground, powdered ginseng (35mg/kg BW) in molasses carrier, and five horses received a blank molasses carrier (placebo). Ginseng used in the study underwent phytochemical analysis for ginsenoside levels. The study was a double-blind, placebo controlled, completely randomized design. Horses received ginseng or placebo for a total of 28 days, and on Day 14 each horse was vaccinated with rhinophenomonitis vaccine. Measurement parameters included antigen-specific antibody formation, total peripheral T-Cell and B-Cell quantitation, CD4+ and CD8+ presenting lymphocytes, and complete haematology and biochemistry blood screens. Changes in antibody levels and lymphocyte profile parameters were determined by calculating the difference between each test day and day zero. The Wilcoxon rank-sum test was used to determine if there were differences between treatment and control groups at each day. Antibody results were ranked using the ranking procedure in SAS and then the GLM procedure with repeated measures was used to determine differences over time. There was a visual trend to increased antibody formation upon vaccination challenge in ginseng-treated animals compared with control animals, but these data did not reach statistical significance. Based on the clear trend shown when data was graphically displayed, it is concluded that this trial provides adequate rationale for further research into the potential for ginseng supplementation to potentiate the immune response of horses. However, future studies must incorporate a larger sample size, fully standardized experimental subjects, and dose titrations for ginseng dose optimization.

Key Words: Ginseng, Vaccination, Equine

1186 Illinois equine checkoff initiative. K Kline*¹, ¹University of Illinois at Urbana-Champaign.

The Horsemen's Council of Illinois, in cooperation with the Illinois Farm Bureau, Illinois Grain and Feed Association, Illinois Department of Agriculture, and representatives of several colleges and universities with equine programs formed a committee in October of 2001 to pursue legislation establishing a Checkoff program to support equine education, promotion and research.

The committee met in December of 2001 to discuss the procedures for developing legislation, defining language, and establishing the structure of the Equine Checkoff Board.

The committee discussed the need to determine board structure as it relates to potential board members, scope of coverage, and authority. Concluding the discussion, the committee reviewed funding and refund procedures to be administered by the board.

Specific recommendations of the committee and subsequent actions of the Equine Checkoff Board will be presented to serve as an example to other states interested in pursuing Equine Checkoffs.

Key Words: Illinois, Equine checkoff, Draft legislation