

SYMPOSIA AND ORAL SESSIONS

Animal Behavior and Well-Being: Behavior-Nutrition Interaction

504 Behavior-nutrition interaction in goats. A. L. Goetsch^{*1}, T. A. Gipson¹, and A. R. Askar², ¹*American Institute for Goat Research, Langston University, Langston, OK*, ²*Animal and Poultry Nutrition Department, Desert Research Center, Cairo, Egypt*.

Factors influencing feeding behaviors of goats include grazing management practices, type of vegetation and season, breed and stage of production, group size, and properties of diets fed in confinement. Considerable information has been gathered from methods such as visual observation during daylight. However, there are now tools available to characterize feeding behavior of goats while grazing and in confinement throughout 24-h periods. Global positioning system collars with motion/position sensors can be used to assess horizontal and vertical distances traveled, up/down position of the head, and movement within pasture/rangeland areas. A commercially available leg activity monitor allows estimation of the number of steps and time spent standing, lying, and moving rapidly without grazing. However, these measurements do not directly determine grazing. Therefore, prediction equations based on visual observation must be developed. Classification tree analysis is a robust method in developing these equations because the decision tree can be pruned or expanded to provide the best fit. Another equipment system is based on patterns of jaw movement to determine time spent eating, ruminating, and idle, although in some instances differentiation between eating and ruminating is subjective. In addition to use of n-alkanes as internal markers to estimate digestibility, their profile can provide an indication of botanical composition of the selected diet. Automated feeding systems for confined goats permit determinations such as number of feeder visits and meals, eating time, and rate and pattern of feed intake. Heart rate measured while goats are in normal production settings can be used to predict total energy expenditure through multiplication by energy expenditure per heart beat of individual animals. To partition the activity energy cost, an estimate of ME intake or measures of change in body energy status and milk energy yield are needed to determine other sources of heat to be subtracted from total energy expenditure. These methods create opportunity to gain a fuller understanding of factors influencing feeding behaviors of goats and their relationships with levels and efficiencies of production.

Key Words: goat, feeding behavior, activity

505 Selection of tannins by sheep in response to gastro-intestinal nematode infections. J. J. Villalba^{*1}, F.D. Provenza¹, J.O. Hall², and L.D. Lisonbee¹, ¹*Utah State University, Department of Wildland Resources, Logan*, ²*Utah State University, Department of Animal, Dairy and Veterinary Sciences, Logan*.

Herbivores select compounds that attenuate the aversive effects of plant secondary metabolites (PSM), but can they learn to increase intake of PSM with medicinal effects when experiencing illness? We hypothesized that herbivores learn to increase intake of PSM-containing foods to combat gastrointestinal parasites. In Exp. 1, four groups of lambs (n=8 lambs/group) were assigned to a 2 x 2 factorial design with parasitic burden (parasitized or not parasitized) and supplemental tannins (yes, no) as the main factors. Parasitized (P) lambs ate more of the tannin-con-

taining food than non-parasitized (NP) lambs (1.4 vs. 0.5 g/Kg BW^{0.75}; SEM= 0.2; P= 0.01) for the first 12 d of the study, when fecal egg counts (FEC) were high (234 eggs/g), but differences became smaller and disappeared toward the end of the study when parasite burdens decreased (P= 0.58). In Exp. 2, 10 lambs with natural gastrointestinal parasitic burdens (P) and 10 non-parasitized lambs (NP) were offered a choice of alfalfa and alfalfa mixed with 10% of quebracho tannin (alfalfa:tannin) before and after they were conditioned with the postingestive effects of tannins in a split-plot design. When tested with a parasite burden, lambs in P consumed more (14 vs. 10 g/Kg BW^{0.75}; SEM= 1.8; P= 0.07), showed greater preference (22 vs. 13%; SEM= 2.9; P= 0.05) for alfalfa:tannin, and consumed less alfalfa (53 vs. 65 g/Kg BW^{0.75}; SEM= 4.8; P= 0.06) than lambs in NP. Preference for alfalfa:tannin did not differ between groups before conditioning, or when parasite loads were terminated due to the administration of ivermectin (P > 0.1). Ingestion of tannins by lambs in P reduced FEC and a direct proportional relationship was observed between preference for alfalfa:tannin and FEC (P= 0.07). Thus, parasitized lambs modified their selection and intake of tannins when they experienced a parasite burden. These results suggest herbivores can self-medicate with potentially toxic compounds. Self-selection of PSM has implications in the quest for alternatives to chemoprophylaxis in the treatment and well-being of wild and domestic animals grazing in pasturelands and in confinement.

Key Words: helminthes, diet selection, plant secondary metabolites

506 Feed volatile compounds affect lambs and ewes palatability. T. Rapisarda¹, A. Mereu², A. Cannas², V. Giovanetti³, S. Carpino^{*1}, and G. Licitra^{1,4}, ¹*CoRFiLaC, Regione Siciliana, Ragusa, Italy*, ²*Dipartimento di Scienze Zootecniche, University of Sassari, Italy*, ³*Agris Sardegna, DRPA, Olmedo, Italy*, ⁴*D.A.C.P.A. University of Catania, Italy*.

Aroma characteristics of feeds can affect their palatability in ruminants. The aim of this research was to correlate the palatability of several feeds used for ruminants with their aromatic profile. Fourteen feeds (soybean meal 44, soybean meal 49, soybean hulls, corn grains, canola meal, wheat grains, beet pulps, sunflower meal, oat grains, pea grains, wheat brans, corn middlings, corn gluten meal and dehydrated alfalfa) were subjected to 6-min palatability tests by using 14 Sarda lambs and 14 Sarda dry ewes in two trials, following 14 (days) x 14 (feeds) Latin square designs. Before the experiments started, the animals went through a training period of two weeks. In the palatability test, the animals were fed a basal diet and were exposed to only one feed per day. The 14 feeds were analyzed by gas chromatography olfactometry and MS for aroma profile and to identify chemical families associated with animal's intake responses. Both sheep and ewes had high intakes of wheat grains, pea grains, corn grains, and beet pulps, probably because of the many pleasant odour compounds present in these feeds. On the other side, both lambs and ewes refused canola meal, dehydrated alfalfa, sunflower meal and oat grains. Sulphur compounds may have influenced negatively the acceptability of dehydrated alfalfa and sunflower meal by lambs and ewes, and a terpene, α -pinene, likely affected negatively the palatability of oat grains. The presence of methanamine, which gives an off-flavour

of rotted fish odour, in sunflower meal and soybean meal 44 probably determined the almost total refusal of the former by both lambs and ewes and the low palatability of the latter in lambs. These results showed that the aroma of several feeds affected animal short-term intake responses. However, more research is needed to better understand the specific compounds and the mechanism underlying feed palatability.

Key Words: palatability, volatile compounds, sheep

507 Behavior-nutrition interactions in horses. D. Sigler*, *Department of Animal Science, Texas A&M University, College Station.*

Domesticated horses sometimes develop abnormal behavioral patterns not observed in feral horses. This has led to undesirable vices, digestive problems and other management issues for horse owners. Imposed stressful environmental conditions also lead to numerous health and nutritional maladies in the domesticated horse. Research has been reported on factors which influence feed intake, feeding behavior and digestion. Recently, much attention has been given to management of digestive abnormalities attributable to behavior and high stress environments. Equine Gastric Ulcer Syndrome (EGUS) is a prevalent condition affecting horses across multiple equestrian disciplines, from racehorses to recreational show horses. Estimates of occurrence range from 40% to 90% of horses, with various stress and management factors being implicated as contributors to ulceration. As EGUS can be detrimental to normal behavior and athletic performance, pharmaceuticals have been employed for the treatment and prevention of ulcers. However, these products are expensive, thus prompting investigation into alternative solutions. Research evaluating the effect of diet on ulceration has found significant relationships between diet and the incidence and severity of EGUS. Specifically, hay type appears to play a role in the severity of EGUS with alfalfa hay causing a reduction in the severity of ulcers when compared to grass hay. In a recent study, EGUS severity scores were reduced in yearlings fed alfalfa hay vs. grass hay. The causative mechanism by which this happens is still unknown. Research which attempts to isolate favorable factors contained in alfalfa hay is ongoing. Other nutritional considerations which also may affect EGUS are protein, mineral levels, concentrate amount and feed forms. Any environmental and behavioral changes which may increase stress also negatively affect EGUS. Researchers should continue to look for management techniques which effectively reduce stress and improve the health and well-being of domesticated horses.

Key Words: equine, nutrition, behavior

508 Effects of Protimax® and Betaine feed supplements on activity in dairy calves. S. C. Tutt*, G. Holub, T. H. Friend, S. M. Garey, and J. E. Sawyer, *Texas A&M University, College Station.*

Dairy calves are often housed in hutches with limited interaction or exercise for up to 8-wk. The objective of this research was to determine the ontogeny of motivation of dairy calves to exercise as they aged from 5-d to 8-wk when housed in hutches and fed different supplements. Forty-four Holstein calves were randomly assigned to four treatment groups: Protimax® supplement (n = 11), Betaine supplement (n = 10), no supplementation (n = 11), and Protimax® and Betaine supplements (n = 12). Recommended feeding of Protimax® is up to 3-wk, at which time Protimax® was discontinued. Calves were housed in hutches with a 2-m x 1.2-m yard and turned loose together for one 2.5-hr period every 7-d. Calves were fitted with pedometers and the percentage of calves that were active, standing, and lying was recorded at 15-min intervals

when loose. Recorded steps, analyzed by repeated measures with calf as the subject in an autoregressive covariance structure, increased during the 8-wk study, from a mean of 1,589 steps in wk 1 to 2,763 in wk 8 ($P < 0.001$). There were no week by treatment interactions, but treatment significantly influenced steps ($P = 0.028$). Calves that were not fed supplement took the most steps, averaging 2,367 steps, while calves given Protimax® averaged 2,243, Betaine 1,961, and both supplements 2,082. To help determine ontogeny, the sum of the percentage of animals lying, standing, and active was multiplied by -1, .5, and 1 respectively, and used as a weekly activity score. Activity scores increased linearly ($\hat{y} = -0.087 + 0.037x$) over the 8-wk period ($P < 0.01$), from -15.5% to 18.4% for wk 1 and 8 respectively. These results suggest that calves' activity consistently increases with age through 8-wk. Assuming steps taken is an indirect measure of health, the supplements did not significantly improve health. Additional research is needed to determine if turning calves loose at regular intervals is useful in improving well-being in production.

Key Words: calves, supplement, activity

509 Effect of feeding method on the learning of feeding behavior in dairy heifers. A. M. Greter*¹, K. E. Leslie², G. J. Mason³, B. W. McBride³, and T. J. DeVries¹, ¹*Department of Animal and Poultry Science, University of Guelph, Kemptville Campus, Kemptville, ON, Canada,* ²*Department of Population Medicine, Ontario Veterinary College, Guelph, ON, Canada,* ³*Department of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada.*

Dietary habits of ruminants are affected by learning early in life. The objective of this study was to determine if long-term exposure to different feeding methods influences the feeding behavior of growing dairy heifers when they are switched to a novel TMR. Thirty-two Holstein heifers (237.2 ± 21.9 d of age; mean ± SD), divided into 8 groups of 4, were exposed for 13 weeks to 1 of 2 treatments: 1) TMR or 2) top-dressed ration (TDR), each containing 65% grass/alfalfa haylage and 35% textured concentrate (DM basis). All heifers were switched to a novel TMR containing 56.1% grass/alfalfa haylage, 21.0% corn silage, 21.0% high moisture corn, and 1.9% mineral supplement (DM basis) for 7 weeks. Group DMI was recorded daily. Feeding behavior was recorded using time-lapse video for 7 d during weeks 1, 4, and 7. Fresh feed and orts were sampled each day of the recording weeks and subjected to particle size analysis. The particle separator contained 3 screens (19, 8, and 1.18 mm) and a bottom pan, resulting in 4 fractions (long, medium, short, and fine). Sorting activity for each fraction was calculated as the actual intake expressed as a % of the predicted intake. To determine if sorting occurred, each fraction was tested for a difference from 100% using t-tests. Effect of treatment was tested using a general linear mixed model with repeated measures. Animals were fecal scored for stool consistency twice weekly using a scale from 1 (liquid) to 4 (normal). Neither DMI (9.2 kg/d) nor ADG (1.0 kg/d) differed between treatments. Sorting also did not differ between treatments. Daily feeding time tended to be higher for the TDR (198.8 vs. 186.8 min/d; SE=4.2; $P=0.09$). As done prior to the dietary change, TDR heifers spent more time at the bunk in the 2 h after feed delivery (40.6 vs. 25.9 min/d; SE=3.8, $P=0.03$). Fecal scores were lower for heifers originally fed the TDR (3.2 vs. 3.7; SE=0.1; $P=0.02$). The continued difference in feeding time suggests that TDR heifers retained this behavior when switched to a novel diet. Furthermore, lower fecal scores for TDR heifers indicate altered rumen fermentation, possibly due to altered diurnal consumption patterns.

Key Words: heifers, feeding behavior, learning