

Ruminant Nutrition: Feed intake

486 Recently identified signals for feed intake regulation. J. L. Miner*, *University of Nebraska*.

Both gastrointestinal distension and presence of nutrients in the digestive tract exert satiating effects. This has been recognized for many decades. However, our understanding of the specific mechanisms by which these stimuli are communicated and translated remains incomplete. Investigation of feed intake regulation in ruminants has historically been aided by descriptions of this biology in rodent models. Thus the role in intake regulation of absorbed chemicals, gut hormones, the vagus nerve, and specific brain nuclei has been confirmed (or modified) in ruminant species. However, much has remained unknown. For example, despite recognition that the brain peptide, NPY, is an extremely potent stimulant of feeding, and concurrent inhibitor of gonadotropes, we have not understood how undernutrition promoted its activity. The recent characterization of leptin in mice, however, has led to the demonstration in sheep that this protein secreted from adipocytes is capable of signaling energy status to the brain, and that at least some of its effects on intake and reproductive hormone secretion are mediated via NPY. Other mechanisms of intake regulation in rodent have recently been described. Agouti-related protein and melanocyte concentrating hormone seem key to hypothalamic intake-stimulating mechanisms. Cocaine-amphetamine-related transcript (CART) peptide and malonyl CoA appear to be part of hypothalamic satiety mechanisms. We may also expect that recently described gut peptides that appear to function in determining feed intake in rodents, perform similar functions in ruminants. For example, glucagon-like peptide-1 and ghrelin are inhibitory and stimulatory, respectively, in rodents. In summary, application of modern molecular biology techniques has led to discovery of several regulatory molecules, some of which have only been characterized in model species. At least one of these, leptin, has significantly contributed to models of how nutritional status is communicated for modulation of feed intake and reproduction in ruminant animals.

Key Words: Cattle, Feed intake, Endocrine

487 Ghrelin, a growth hormone secretagogue, is expressed by bovine rumen. P. C. Gentry*, J. P. Willey, and R. J. Collier, *University of Arizona*.

The growth hormone secretagogue ghrelin is an important regulator of energy metabolism, nutrient partitioning and feeding behavior. Although it has been detected in a variety of tissues, the stomach is the primary source of ghrelin, while receptors are located in the pituitary and hypothalamus. Ghrelin levels peak prior to a meal and subside dramatically immediately after. In addition to stimulating pituitary growth hormone secretion, exogenous ghrelin reduces fat utilization, induces adiposity and provokes food intake in humans and mice. Thus, ghrelin is an important endocrine link between the gastrointestinal tract and brain. To date, the role of ghrelin in ruminants remains unexamined. Our objective was to determine if ghrelin is expressed in pre-ruminant and ruminant calves and to assess distribution of ghrelin mRNA expression throughout the gastrointestinal tract. Expression of ghrelin was assessed by semi-quantitative RT-PCR in Holstein bull calves at 4 (n=6) and 12 (n=5) wk of age. Calves were fed colostrum at birth and for at least three subsequent feedings, followed by a commercial milk replacer. Calves were fed twice daily at 7 AM and 6 PM. Beginning on d

12, calves were offered a corn-based calf starter feed, free choice. Calves were euthanized at 7 AM on the day of slaughter and were not fed. Primers spanning nucleotides 40-488 of the ghrelin coding region were used to amplify ghrelin from total cellular RNA from rumen, reticulum, omasum, abomasum, duodenum, jejunum, ileum and abdominal adipose tissue. Ghrelin was detected in rumen and abomasum but not in other tissues. When corrected for differences in RNA input by normalizing to the housekeeping gene G3PDH, ruminal expression was greater in 12 wk calves than in 4 wk calves, corresponding to the increase in rumen function occurring during this period. Further studies characterizing ghrelin expression in cattle under differing dietary and growth conditions are in currently in progress, as are experiments to determine cellular sites of ghrelin expression.

Key Words: Ghrelin, Energy metabolism, Ruminant

488 Evaluation of the DMI predictions of the Cornell Net Carbohydrate and Protein System model with Holstein and dual-purpose lactating cattle in the tropics. D. O. Molina*¹, I. Matamoros², Z. Almeida², L. O. Tedeschi¹, and A. N. Pell¹, ¹*Cornell University, Ithaca, NY, USA*, ²*Escuela Agrícola Panamericana Zamorano, Honduras*.

Data from three experiments were used to evaluate the DMI predictions of version 5.0 of the Cornell Net Carbohydrate and Protein System (CNCPS) in tropical conditions in 3 production settings in Honduras. Experiment 1 was conducted with 12 lactating Holstein cows in individual stalls at a research farm. The cows received known amounts of supplements and fresh, chopped *Panicum maximum* cv Tobiatá grass and intake was measured daily. Intake of grazing cattle was evaluated in Experiments 2 and 3 using the alkane technique over 8-d periods. Experiments 2 (commercial farm) and 3 (research farm) included 12 and 13 crossbreed dual-purpose cows rotationally grazing *Cynodon nlemfuensis* cv Alicia and *Panicum maximum* cv Tobiatá grass, respectively, with appropriate supplementation. Model predictions were evaluated by regressing the observed (obs) values (Y variable) on the predicted (pred) values (X variable). Mean bias and mean square prediction error (MSPE) were calculated. Differences between obs and pred values were evaluated using a 2-tailed t-test. Model-predicted DMI (18.2 kg/d) was close to the observed values (18.0 kg/d), with a mean bias of - 0.19 kg DM/d, suggesting that the CNCPS accurately predicted intake of confined lactating animals in tropical conditions. The intake predictions by the CNCPS for the grazing dual-purpose lactating cows were not as accurate. The CNCPS model underpredicted DMI in experiment 2 (10.7 kg/d obs versus 12.8 kg/d pred), with a mean bias of - 2.04 kg DM/d, and DMI was overpredicted in experiment 3 (12.5 kg/d obs versus 12.2 kg/d pred), with a mean bias of 0.45 kg DM/d. For the three experiments, the slope of the regression between observed and predicted DMI did not differ from unity, but the intercept differed ($P < 0.05$) from zero, indicating a prediction bias. Accurate intake data from grazing animals is difficult to obtain and errors in the estimation of herbage intake using the alkane method may have contributed to the bias in the predictions by the CNCPS model.

Key Words: CNCPS, Dry mater intake, Tropical pasture

Sheep: Sheep production and management

489 Out-of-season breeding in hair sheep using Melenigestrol Acetate (MGA). N. C. Whitley¹, D. J. Jackson*¹, and S. Schoenian², ¹*University of Maryland Eastern Shore*, ²*Maryland Cooperative Extension, WMREC*.

Thirty-two Katahdin and crossbred Katahdin ewes were group-fed one of two diets, a commercial diet containing MGA (n=16; MGA) or a commercial diet with no MGA (n=16; CON) for a period of 10 d after being removed from rams for 21 days prior to the start of treatment. The MGA group was fed to provide approximately .25 mg/ewe of MGA/day while the CON group was fed an equivalent amount of a control diet. Following the treatment period, ewes were grouped for mating (=d0) with two rams wearing marking harnesses for 14 days. Ewes were

checked twice daily for estrus and numbers mated was recorded to determine days to first mating and percentage mated. Blood samples were collected for serum estrone sulfate (ES) radioimmunoassay at approximately 52.1±.5 and 112.2±.5 days after mating for pregnancy detection. Days to first mating tended ($p < .08$) to be lower for MGA-treated ewes compared to CON ewes, averaging 2.3±.6 and 4.3±.9, respectively. The percentage of ewes mated was higher ($p < .01$) for MGA-treated ewes (100±8.8%) compared to CON ewes (37.5±8.8%). Pregnancy rates could not be determined based on serum ES concentrations in this study and concentrations were not influenced by treatment, averaging 7.7±.1 and 5.9±.1 ng/ml for days 52 and 112, respectively. Lambing rate per ewe exposed and per ewe mated were both higher ($p < .01$) for MGA-

treated ewes (75.010.9 for both) compared to CON ewes (6.3±9.05% and 16.7±17.8%, respectively). Number of lambs born per ewe mated was also greater ($p < .03$) for ewes treated with MGA (1.4±.23 lambs) compared to CON ewes (.33±.38 lambs), but number of lambs born per ewe lambing (1.8±.15 lambs) and total litter birth weight (7.0±.36 kg) was not influenced by treatment. Day 112 serum ES concentrations for ewes lambing tended to be positively correlated with total litter birth weight ($r^2 = .30$, $p < .07$), but not with number of lambs born ($r^2 = .21$, $p < .14$). Overall, progesterone priming in combination with the ram effect in hair sheep increased fertility and fecundity of ewes bred during summer.

Key Words: MGA, Hair sheep, Ram effect

490 Effect of breed type on shear force, sensory analyses and fatty acid content of lamb. S. P. Greiner^{*1}, S. K. Duckett², and D. R. Notter¹, ¹Virginia Polytechnic Institute and State University, Blacksburg, ²University of Georgia, Athens.

Eighty eight lambs from two locations (L1, L2) were evaluated to assess breed differences in longissimus muscle tenderness, sensory attributes, and fatty acid content. At L1, Dorper (DP) and Dorset (DO) crossbreds (out of -DO, -Rambouillet, -Finnsheep ewes) were produced in 2000 and 2001, along with straightbred Katahdin (KT) and Barbados Blackbelly x St. Croix (HH) wethers in 2001. At L2, DP and Suffolk (SU)-sired lambs (out of SU ewes) were produced in 2001. Lambs were weaned at 90 d of age, grazed, and then fed a high-concentrate diet prior to slaughter at 8 mo of age. Racks from carcasses were aged at 4°C for 10 d and frozen at -20°C for subsequent Warner-Bratzler shear force (WBS), sensory, and fatty acid (FA) analyses. Chops were rated by a trained sensory panel for tenderness (T), juiciness (J), lamb flavor (LF), and off-flavor (OF) using a 8-point scale (1 = extremely tough, dry, and bland; 8 = extremely tender, juicy, and intense). FA content of intramuscular lipid was determined by GLC. A model that fit location and breed type was used to evaluate DP vs non-DP (ND; DO and SU) breed types. No breed by location interactions were observed. WBS values were 0.62 kg lower ($P < 0.01$) for DP than ND (2.38 vs 3.00 SEM = 0.15). Similarly, panelists rated DP more T ($P < 0.01$) than ND (5.51 vs 5.02 SEM = 0.08). J, LF, and OF were similar ($P > 0.32$) for DP and ND. Concentrations of stearic, palmitic, and lauric acids were higher ($P < 0.05$) in DP-sired lambs, whereas the percentage of linoleic acid was lower ($P < 0.05$). DP tissues had higher ($P < 0.05$) percentages of total saturated FA, along with lower ($P < 0.05$) percentages of monounsaturated and polyunsaturated FA than ND. At L1 in 2001, WBS

values were higher ($P < 0.05$) for DO than DP and KT. WBS values were similar ($P > 0.05$) for DP, KT, and HH lambs. HH lambs received higher ($P < 0.05$) and more desirable T scores than DO and KT lambs. However, no differences were detected between breed types for J, LF, or OF. Longissimus tenderness was improved with Dorper genetics.

Key Words: Lamb, Sensory evaluation, Fatty acid

491 Effects of low protein and limit-fed corn based diets on diet digestibility and metabolism of N and P in sheep. M. Abdullah^{*1}, S. C. Loerch², P. Tirabasso², and G. D. Lowe², ¹University of Agriculture, Faisalabad, Pakistan, ²OARDC, The Ohio State University, Wooster, OH 44691.

Low protein and limit-fed diets decrease excretion of N and P and help decrease environmental pollution. Twelve wether lambs (42kg BW) grouped into three blocks and kept in metabolic crates, were fed the experimental diets to determine the effects of low protein and limit-fed corn-based diets on DM digestibility and N and P metabolism. Treatment were; i) ad libitum intake, corn-SBM control, ii) limit-fed (2.5% of BW), low N and P corn diet, iii) ad libitum intake, low N and P soy hull-corn silage diet, and iv) limit-fed (2.5 % of BW), low N and P soy hull-corn silage diet. The trial consisted of a 19 d period, 14 d for adaptation and 5 d for total collection of feces and urine. N intake by lambs fed the low N diets was about 38% lower ($P < .05$) than that of lambs fed the control diet. Lambs fed the soy hull-corn silage based diets consumed 45% less ($P < .05$) P than those fed the corn-based diets. Fecal output (g/d) by lambs fed soy hull-corn silage-based diets was nearly two times greater ($P < .05$) than that of lambs fed corn-based diets. Fecal N output followed a similar trend, but fecal P output was not affected ($P > .05$) by diet. DM ($P < .001$) and N ($P < .01$) digestibility was lower for ad libitum or limit-fed soy hull-corn silage diets than for the control or limit-fed (low N and P) corn diet. N and P retention (g/d) was also lower ($P < .05$) for the limit-fed corn diet and ad libitum or limit-fed soy hull-corn silage diet. N retention was negative for the limit-fed low N and P soy hull-corn silage diet. Similar trend was observed for N retention as % of N intake. N retention as % of N digested was negative ($P < .05$) for the limit-fed low N and P soy hull-corn silage diet, whereas, no difference was found between control, limit-fed corn and limit-fed soy hull-corn silage diets. High fiber, lower digestibility diets increase N excretion and decrease N retention (regardless of intake level), compared with corn-based diets.

Key Words: Low protein diets, Limit feeding, N and P metabolism

Animal Behavior & Well Being Symposium: Alternative housing for livestock

679 Current and future trends in dairy housing. G. L. Bethard^{*1} and J. G. Martin², ¹G&R Dairy Consulting, Inc., ²Joseph G Martin Consulting Engineer.

Dairy Housing has changed markedly over the last 30 years. Most new dairy facilities in the United States are either free stall confinement housing, or dry lot housing in areas with minimal rainfall. Many older facilities were designed to provide worker comfort and labor efficiency. Buildings in warm and cold weather climates were designed to minimize worker exposure while restricting ventilation. The impact of facility design on animal performance was rarely measured. More recently, researchers have measured the impact of facilities on the cow's ability to handle stressful environmental conditions such as heat, cold, and overcrowding. In particular, heat abatement has been a critical design component in most regions of the United States. Handling waste has become a major issue, with scrape or flush systems predominant. The dairy industry has moved away from worker comfort to cow comfort, realizing that comfortable cows are healthier, more productive and profitable. Dairy design goals are to ease manure handling and maximize cow comfort, labor efficiency, and productivity while minimizing investment. Future trends will focus on improving cow comfort and productivity, with an increasing emphasis on heat abatement.

Key Words: Dairy housing, Free stall, Heat abatement

619 Housing the sow without crates - challenges and solutions. J. N. Marchant-Forde^{*}, USDA-ARS.

Confining sows in crates throughout gestation, farrowing and lactation is commonplace in North America. In Europe, crating the sow throughout gestation will be prohibited from 2013 and the farrowing crate continues to be scrutinized by a powerful animal well-being lobby. In North America, major retailing chains are already introducing welfare guidelines and the issue of sow housing is an area that is attracting a great deal of attention, not least because of recent legislation enacted in Florida. However, loose housing of the gestating and farrowing sow does present real challenges that need to be addressed in order to safeguard pig well-being and ultimately, productivity. The major challenge of group housing the gestating sow is that of inter-sow aggression. Sows will fight especially when mixed and when having to compete for access to resources. Therefore, the ways in which sows are introduced to each other and how they are fed are major factors in determining the success or failure of a system, both in well-being and productivity terms. For loose-housed farrowing sows, the major challenge is that of safeguarding the well-being of her piglets, in terms of pre-weaning mortality and ensuring even growth. Over the last decade, aspects of sow housing have undergone a great amount of research. Although the majority of this work has been carried out outside of North America, many of the research results are likely to be directly applicable to the swine industry here. This paper will highlight work done to date with a focus on the development of practical solutions, derived from both system design and system management techniques, that allow the skilled and motivated stockperson to work what are called