

Ammonia (NH₃) and greenhouse gas (GHG) emissions from concentrated feeding operations are a concern. The poultry industry has successfully used aluminum sulfate (Alum) as a litter amendment to reduce NH₃ emissions from poultry barns. Alum has not been evaluated for similar uses on cattle feedlot surfaces. The objective of this study was to measure NH₃, GHG, and hydrogen sulfide (H₂S) emissions from feedlot surface material (FSM) containing 0, 2.5, 5, or 10% Alum over a 32-d period in lab-scale pans containing FSM. Pans containing FSM were sampled every other day for the first 2 wk, and twice weekly thereafter. Results were analyzed as repeated measures using the MIXED procedure of SAS. Average pH of the FSM was significantly lower ($P < 0.01$) when 2.5, 5, and 10% Alum was included (5.3, 4.4, and 4.2, respectively) compared to 0% Alum (8.1). After 5 d, the pH of FSM containing 2.5% Alum (4.1) was higher ($P < 0.01$) than FSM with 5 and 10% Alum (3.8 and 3.5, respectively). Ammonia emissions were immediately reduced from FSM that received Alum, with no NH₃ volatilization occurring below pH 6.5. Overall NH₃, carbon dioxide and nitrous oxide levels were lower ($P < 0.01$) from FSM containing Alum than those without, with the 10% Alum providing the greatest reduction in emissions. Hydrogen sulfide emissions were higher ($P > 0.01$) at 0 and 10% inclusion (67 and 104 ppb, respectively) compared to 2.5 and 5% inclusions (56 and 62 ppb, respectively). Total nitrogen content of FSM did not differ among treatments ($P < 0.10$), but ammonium-nitrogen was highest ($P < 0.01$) when 10% Alum was used (2.58 g kg⁻¹). Application of Alum to FSM will reduce NH₃ and GHG emissions, but H₂S emission will increase at the 10% inclusion. Therefore, 5% Alum inclusion appears the most beneficial to reducing NH₃ and GHG emissions from cattle feedlots. USDA is an equal opportunity provider and employer.

Key Words: aluminum sulfate, ammonia, greenhouse gas

470 The Relationship between Blood Metabolites and Hormones with Intake, Gain, and Efficiency in Beef Cattle Consuming Forage then Concentrate Diets. M. S. Grant^{*1}, A. P. Foote², ¹USDA, Agriculture Research Service, Meat Animal Re, Clay Center, NE, ²USDA, ARS, US Meat Animal Research Center, Clay Center, NE

The objective of this experiment was to determine if selected blood metabolites and hormones are related

to DMI, ADG, and efficiency in cattle consuming a variety of diets. Approximately 50-d post-weaning, a group of crossbred heifers ($n=76$) were fed a forage-based diet containing (DM basis) 69.8% corn silage, 30% alfalfa hay, and 0.2% salt for 84 d in a Calan gate system to measure individual feed intake. BW was measured at 7 time points and a blood sample was collected on d 42 via jugular venipuncture. Following the first 84-d period, heifers were transitioned to a finishing ration containing 67.7% dry rolled corn, 20% wet distiller's grains, 8% alfalfa hay, and 4.3% vitamin and mineral supplement. Feed intake, BW, and a blood sample were collected in the same manner as on the forage-based ration. Daily DMI, ADG, G:F, and RFI were calculated. Plasma samples were analyzed for insulin, glucagon, glucagon-like peptide-1 (GLP-1), glucose, lactate, triglycerides, cholesterol, and β -hydroxybutyrate (BHBA). Data were analyzed using the CORR procedures in SAS. Insulin, GLP-1, and glucagon concentrations were greater on the concentrate ration compared to the forage ration ($P < 0.01$). On both diets, there was a negative correlation between DMI and both glucose and lactate concentrations ($P < 0.05$). Additionally, no correlation between GLP-1 and DMI was observed on the forage ($P = 0.60$) or concentrate ($P = 0.27$) diet. On the forage ration, there was a negative correlation between glucagon and ADG, DMI, and G:F ($P < 0.05$). There was also a negative correlation between triglyceride concentrations and ADG, DMI, and G:F on the forage ration ($P < 0.05$). On the concentrate ration, cholesterol was negatively correlated with G:F ($P < 0.01$) and positively correlated with DMI ($P < 0.05$) and RFI ($P < 0.01$). β -hydroxybutyrate concentrations were found to be negatively correlated with DMI on the concentrate ration ($P < 0.01$). Results indicate that diet has an impact on metabolism and diet can impact how metabolism relates with production measures. It also appears there is potential to find commonalities across diets regarding metabolism and efficiency.

Key Words: feed efficiency, beef cattle, metabolism

471 Evaluation of Medium Chain Fatty Acids As a Dietary Additive in Nursery Pig Diets. K. A. Thomson^{*}, J. T. Gebhardt, A. B. Lerner, J. C. Woodworth, M. D. Tokach, J. M. DeRouchey, B. D. Goodband, S. S. Dritz, Kansas State University, Manhattan, KS

A total of 360 pigs [(400 × 200, DNA, Columbus, NE initially 6.7 kg BW) were used in a 35-d study to evaluate the effects of medium chain fatty acids (MCFA;

d 0 to 35:	ADG, g	ADFI, g	G:F
Control	423	630	0.673
0.25% MCFA	436	621	0.702
0.5% MCFA	457	642	0.712
1.0% MCFA	461	667	0.692
1.5% MCFA	472	664	0.712
0.5% C6	451	644	0.700
0.5% C8	457	649	0.705
0.5% C10	441	630	0.700
SEM	9.1	14.1	0.0065

C6, C8, and C10) as a dietary additive on nursery pig growth performance. Pigs were weaned at 21 d of age and allotted to pens based on BW. Pigs were fed a commercial starter diet for 6-d prior to the start of the experiment. Pens of pigs were then assigned to 1 of 8 dietary treatments in a randomized block design by BW with 5 pigs per pen and 9 pens per treatment. Dietary treatments were: 1) a control diet without MCFA; 2-5) control diet containing a 1:1:1 blend of C6, C8, and C10 at 0.25, 0.50, 1.0 or 1.50% total MCFA; 6-8) control diet containing 0.50% C6, C8 or C10. Dietary treatments were fed for 35 d with pig weights and feed disappearance measured weekly to determine ADG, ADFI, and G:F. Data were analyzed using a generalized linear mixed model with pen as the experimental unit. For the overall period (d 0 to 35), pigs fed increasing MCFA blend had improved (linear; $P < 0.05$) final BW, ADG, ADFI, and G:F. Pigs fed C6 alone or C8 alone had increased ($P < 0.05$) ADG, G:F, and final BW compared to pigs fed the control diet. There was no evidence ($P > 0.05$) for difference between feeding the MCFA alone at 0.50% of the diet compared to pigs fed the 0.5% 1:1:1 blend diet. In conclusion, increasing MCFA blend improved growth performance. Additionally, inclusion of C6 or C8 to the diet resulted in improved ADG and G:F compared to pigs fed the control diet.

Key Words: growth performance, medium chain fatty acid, nursery pigs

472 Effects of Enrichment Tools on Dairy Calves

Housed in Hutches. G. A. Norden^{*1}, T. L.

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Housing and feeding young calves individually is a common management practice to increase weight gain, improve feed conversion and allow for dairy cows to yield more milk. Calves, as herd animals, have increased stress when separated from their mothers and other

calves. Previous research has examined enrichment usage in group housed and feedlot cattle to examine effects on weight gain. Enrichment has been shown to be a welfare-friendly solution to decrease stress levels in large groups, but little research has examined effects on individually housed animals. The current study focused on individually housed dairy calves with enrichment to examine enrichment preference and effects on feed conversion ratio. Six Holstein calves, 4 males and 2 females, were used in a 3 by 3 Latin square with 2 calves in each of 3 treatments. Treatment A was stationary brushes mounted on a post for calves to scratch on. Treatment B enrichment had movable bottles wrapped in AstroTurf. Treatment C was the control group with no enrichment. Every 14 d the enrichment was moved to a new group until each group experienced all treatments. Each calf was observed for 5 h/wk. During wk 1, a difference was noted with brushes being favored over bottles, 827.5 s and 482.5 s respectively ($P = 0.096$). However, no difference was noted between brushes (487.5 s) and bottles (470.0 s) in wk 2 ($P = 0.615$). Feed conversion had no differences in wk 1 ($P = 0.647$) or wk 2 ($P = 0.586$) when comparing treatment to the control. However, brushes (7.913) and bottles (7.117) during wk 2 had a difference in feed conversion ratios ($P = 0.057$). Decreased feed conversion of the preferred enrichment could be due to increased energy and decreased resting time of the calf with the preferred enrichment and a decrease of stereotypical behaviors in the non-favored enrichment.

Key Words: Enrichment, calves, hutches

473 Effects of Feeding Organic and Conventional Mineral Supplements on Dam Weight throughout the Last Period of Gestation in Nubian Goats. A.

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Proper nutrition for caprine dams throughout gestation, especially during the third trimester, is imperative to health (i.e. bone development, increased birth weight, immunity) of the unborn kid. In recent years, organic farming has become a more common practice as many consider organic products to be superior. However, research on beneficial effects of organic supplementation is lacking in goats. The objective of the current experiment was to examine the effects of feeding conventional or organic mineral supplements on Nubian goat dam wt during the last 6 wks of gestation. Ten gestating Nubian does, ranging from 1 to 3 yrs of age and BW varying 45.36 to 65.77 kg, were selected during the