

Nonruminant Nutrition: Nutritional Values II

723 Diurnal variation of amino acid digestibility in pigs. B. G. Kim*¹ and H. H. Stein², ¹*Konkuk University, Seoul, Republic of Korea*, ²*University of Illinois, Urbana*.

The index method is widely used to avoid the quantitative collection of ileal digesta or feces in digestibility experiments. Diurnal variations of indigestible index and CP concentrations in ileal digesta samples have been reported. However, diurnal variations of ileal AA concentrations and ileal AA digestibility are unknown. Therefore, we determined the concentration of AA in ileal digesta and ileal digestibility of AA in various collection-time periods. Eight barrows with an initial BW of 34.6 kg (SD = 2.1) fitted with a T-cannula in the distal ileum were randomly allotted to a duplicated 4 × 4 Latin square design with 4 diets and 4 periods per square. Three diets contained corn, soybean meal, or distillers dried grains with solubles as the only source of AA in each diet. An N-free diet was also prepared. All diets contained 0.5% chromic oxide. Equal meals were provided at 0800 and 2000. Ileal samples were collected with 2-h intervals from 0800 to 2000 during the last 3 d of each 7-d period. The concentrations of Lys, Met, Thr, Ile, His, Leu, and Phe in ileal samples were affected ($P < 0.05$) by collection time in pigs fed non-N-free diets during the 12-h collection. The apparent ileal digestibility of all indispensable AA (IAA) exhibited a quadratic response ($P < 0.01$) that increased and then decreased by collection time in pigs fed non-N-free diets. The endogenous losses of all IAA except Trp and Arg decreased (linear and quadratic, $P < 0.05$) by collection time. The standardized ileal digestibility of all IAA except Arg was also affected (linear and quadratic, $P < 0.05$) by collection time. Standardized ileal digestibility of all IAA calculated from samples collected for 2 h from 6 h after feeding was comparable (less than 0.6 percentage unit deviation, $P > 0.64$) to the 12-h digestibility value calculated using chromium and AA concentrations of the 12-h collection: Concentration, % = Σ (concentration, % × sample, g) ÷ Σ sample, g. Overall, diurnal variations of AA concentration in ileal digesta and ileal AA digestibility exist, and we suggest that 2 h of ileal sample collection from 6 h after feeding may provide a fairly representative AA digestibility.

Key Words: collection period, ileal digestibility, index method

724 Effects of adjusting the standardized ileal digestible (SID) amino acids in heat damaged soybean meal (SBM) or distillers dried grains with solubles (DDGS) in diets on performance of weaned pigs. F. N. Almeida*¹, J. K. Htoo², J. Thomson³, and H. H. Stein¹, ¹*University of Illinois, Urbana*, ²*Evonik Industries, Hanau, Germany*, ³*Evonik Degussa Corporation, Kennesaw, GA*.

Two experiments were conducted to determine if adjustments of the SID of AA in heat damaged (HD) SBM or HD DDGS in diet formulation ameliorates performance reduction by heat damage in weaned pigs. In Exp. 1, 4 corn-SBM diets were formulated. The positive control (PC) diet, containing conventional SBM (35.1%), was formulated on the basis of analyzed AA and published SID values. Diet 2, negative control (NC), was like the PC but conventional SBM was replaced (1:1) with HD SBM (autoclaved at 125°C; 60 min). Diet 3 contained HD SBM but was based on analyzed AA and published SID values. Diet 4 also contained HD SBM, but was formulated on analyzed AA and by adjusting the SID of AA for HD SBM based on values derived from a previous study. Pigs (160; 10.4 kg BW) were allotted to 4 diets with 8 replicate pens per diet. On wk 1, ADG of pigs fed diet 4 (0.33 kg) was better ($P < 0.05$)

than diets 2 (0.23 kg) and 3 (0.30 kg), but not different from PC (0.35 kg). On wk 1–3, ADG and G:F was greater ($P < 0.05$) for pigs fed the PC diet than pigs fed the other diets, and pigs fed diet 4 had greater ($P < 0.05$) ADG and G:F than pigs fed the NC diet (0.44 vs. 0.35 kg and 0.48 vs. 0.44, respectively). In Exp. 2, 144 pigs (9.9 kg BW) were allotted to 4 diets with 8 replicate pens per diet. Diets (corn-SBM-DDGS based) were formulated using the concepts described for Exp. 1, except that HD DDGS (autoclaved at 130°C for 60 min; 22% inclusion) but not HD SBM was used in diets. On wk 1, G:F of pigs fed diet 4 (0.36) was better ($P < 0.05$) than diets 2 (0.28) and 3 (0.32), but not different from PC (0.38). On wk 1–3, ADG was not affected but G:F was greater ($P < 0.05$) for pigs fed the PC diet than pigs fed the other diets mainly attributed to a greater ADFI in pigs fed diets containing HD DDGS. In conclusion, negative effects of heat damage in SBM or DDGS on performance of weaned pigs can be ameliorated at least during wk 1 if the reduction in concentration and the digestibility of AA are adjusted for the impact of heat damage.

Key Words: distillers dried grains with solubles, soybean meal, weaned pig

725 Prediction of voluntary feed intake in finishing pigs using physicochemical properties of bulky feeds. S. P. Ndou*, A. G. Bakare, and M. Chimonyo, *Animal and Poultry Science, University of KwaZulu-Natal, Pietermaritzburg, South Africa*.

The objective of the present study was to determine the physicochemical properties that predict voluntary feed intake (VFI) of bulky diets in finishing pigs. A total of 84 pigs weighing 65 ± 1.37 kg body weight (BW) were given, ad libitum, each of the 21 diets containing a basal feed diluted with 80, 160, 240, 320 and 400 g/kg of alfalfa hay, corn cob, sawdust or sunflower husks. The basal feed contained 12.3 MJ digestible energy and 160 g of CP/kg DM. Physicochemical properties of the feeds measured were dry matter (DM), crude protein (CP; g/kg DM), ether extract (g/kg DM), ash (g/kg DM), water holding capacity (WHC; g water/g DM), bulk density (g DM/ml), crude fiber (CF; g/kg DM), neutral detergent fiber (NDF; g/kg DM) and acid detergent fiber (ADF; g/kg DM). Each of the 21 diets was given to 4 pigs, in individual pens, for 31 d, inclusive of a 10 d adaptation period. The feed intake and live BW were determined for each pig, every week. Mixed model procedures for repeated measures was used to analyze the data set (SAS, Version 9.1). Stepwise regression was used to identify significant physicochemical properties that affect SFI and relationships between measured parameters were determined by the response surface option of regression (SAS, Version 9.1). Neutral detergent fiber ($R^2 = 0.86$; $P < 0.05$), CF ($R^2 = 0.76$; $P < 0.05$), CP ($R^2 = 0.75$; $P < 0.001$) and WHC affected ($R^2 = 0.74$; $P < 0.01$) SFI. There was a quadratic relationship between SFI and NDF given by the function $SFI = 82.0$ (SEM 5.30) $- 0.18$ (SEM 0.03) NDF + 0.0002 (SEM 0.00004) NDF² ($P < 0.01$). The SFI was related to CF and CP by quadratic functions; $SFI = 63.4$ (SEM 2.22) $- 0.16$ (SEM 0.03) CF + 0.0003 (SEM 0.00007) CF² ($P < 0.001$) and $SFI = 61.8$ (SEM 9.68) $- 0.39$ (SEM 0.16) CP + 0.002 (SEM 0.0006) CP² ($P < 0.01$), respectively. The SFI was related to WHC by linear function; $SFI = 77.3$ (SEM 4.37) $- 7.43$ (SEM 1.77) WHC ($P < 0.001$). In conclusion, although threshold values were not identified, WHC, NDF and CF content provide relationships with SFI that can be used to predict voluntary feed intake in finishing pigs.

Key Words: dietary fiber, water-holding capacity, feed intake

726 Effects of reducing the particle size of corn on energy, phosphorus, and amino acid by growing pigs. O. J. Rojas* and H. H. Stein, *University of Illinois at Urbana-Champaign, Urbana.*

Two experiments were conducted to determine the concentration of DE and ME, the standardized total tract digestibility (STTD) of P, and the standardized ileal digestibility (SID) of CP and AA in corn ground to 4 different particle sizes (i.e., 339, 485, 677, and 865 μm). In Exp. 1, 40 growing barrows (initial BW 22.8 ± 2.1 kg) were placed in metabolism cages and allotted to a randomized complete block design with 4 diets and 10 replicate pigs per diet. One lot of corn was divided into 4 batches that were ground to the specified particle sizes and each batch was used in one diet that contained 97.7% corn (as-fed basis). Vitamins and minerals were included in the diets to meet the requirements for growing pigs with the exception that no inorganic P was used and all the P in the diets originated from corn. The concentration of ME was 3,964, 3,895, 3,868, and 3,826 kcal/kg DM for corn ground to a mean particle size of 339, 485, 677, and 865 μm , respectively. The ME concentration decreased (linear and quadratic, $P < 0.01$) as the particle increased. The STTD of P was 37.8, 37.1, 37.3, and 37.4% for corn ground to a mean particle size of 339, 485, 677, and 865 μm , respectively, and these values were not different. In Exp. 2, 10 growing barrows (initial BW: 29.2 ± 1.35 kg) were surgically equipped with a T-cannula in the distal ileum and randomly allotted to a replicated 5×5 Latin square design with 5 diets and 5 periods in each square. Four of the diets contained each batch of corn ground to a different particle size (96.6%, as-fed basis) as the only source of AA. A N-free diet was used to determine endogenous losses of CP and AA. With the exception of Trp, there was no effect of corn particle size on the SID of CP or any indispensable AA. In conclusion, reduction of the particle size of corn from 865 to 339 μm linearly increased the concentration of ME in the corn, but the particle size of corn does not affect the STTD of P or the SID of indispensable AA and CP.

Key Words: corn, particle size, pig

727 Net energy value of field pea, Napus and Juncea canola meals, and wheat millrun fed to growing-finishing pigs. T. A. Woyengo*¹, S. Moehn¹, E. Beltranena^{1,2}, and R. T. Zijlstra¹, ¹*University of Alberta, Edmonton, AB, Canada*, ²*Alberta Agriculture and Rural Development, Edmonton, AB, Canada*.

A study was conducted to determine NE value of field pea (FP), Napus canola meal (NCM) and Juncea canola meal (JCM), and wheat millrun (WM), which are available as alternative feedstuffs for pigs in Canada. Six ileal-cannulated barrows (38 kg) were fed 6 diets in 5×5 Latin square design with 1 added column to give 6 replicates per diet. Diets contained either SBM, FP, NCM, JCM, or WM and between 4.23 and 58% of a N-free mix (constant ratio mix of cornstarch, sugar, canola oil, and cellulose). Soybean meal (SBM) was included as a reference. Diets were formulated to contain at least 0.86% standardized ileal digestible Lys, and Met, Thr, and Trp based on ideal AA ratio. Energy digestibility, DE, ME, and NE values of the feedstuffs were calculated by difference from N-free mix using values of the N-free mix from our previous study. On DM basis, SBM, FP, NCM, JCM, and WM contained 51, 28, 41, 42 and 18% CP; and 8.5, 20, 29, 21, and 38% NDF, respectively. Apparent total tract GE digestibility values of SBM, FP, NCM, JCM, and WM were 84, 86, 69, 72, and 74%, respectively, and were different ($P < 0.05$) from each other. The DE, ME and NE values for SBM were 3.86, 3.62 and 2.56 Mcal/kg DM, respectively. The DE value of FP, and DE and ME values of NCM, JCM, and WM were lower ($P < 0.05$) than that of SBM. The SBM and FP did not differ in ME. The NE values of FP, JCM, and WM were 2.32, 2.21, and 2.57 Mcal/kg DM, respectively, and were not different from that of SBM. The NE value of NCM was, however, lower ($P < 0.05$) than that of SBM by 23%. The standard error of mean for DE, ME and NE data was 0.03, 0.12, and 0.24, respectively. In conclusion, the NE value of NCM was lower than that of SBM likely due to the lower energy digestibility, and the higher fiber content of the NCM than SBM. However, it is difficult to firmly conclude that NE values of FP, JCM, and WM were not different from that of SBM due to the higher variability of NE data than of DE or ME data.

Key Words: feedstuff, net energy, pig