were given a score of 0 to 6 with 0 representing no visible cracks or shattering in the fat and 6 representing a spider-web-like consistency of shattering. Shatter of bacon slices decreased (linear, $P < 0.001$) with increasing level of dietary DDGS (4.37, 4.10, 3.55, 3.54). TBARS determined on Bratwurst sausages increased linearly with DDGS level (d 7: 1.03, 0.95, 1.18, 1.38 mg/kg; $P < 0.03$). An 8-member trained panel evaluated fried bacon slices, sausage, and loin chops. Fried bacon distortion scores were unaffected by treatment (2.68, 2.46, 2.51, 2.56; higher score indicates more curling). DDGS level did not influence texture or off-flavors in bacon slices nor tenderness, juiciness, or off-flavors in loin chops. However, DDGS did influence texture (less mushy and more chewy; 8.46, 6.97, 7.38, 6.52; $P < 0.004$) and increased juiciness (6.70, 7.50, 7.38, 8.19; $P < 0.04$) in sausages. The results indicate that the softer carcasses associated with feeding DDGS did not negatively affect quality of fresh bacon slices nor eating quality of bacon, sausage, or loin chops.

Key Words: pigs, DDGS, pork quality

159 Attempts to improve belly firmness in finishing pigs fed a high level of DDGS. M. C. Ulery*[1], G. L. Cromwell[1], G. K. Rentfrow[1], M. D. Lindemann[1], and M. J. Azain[2], [1]*University of Kentucky*, *Lexington*, [2]*University of Georgia*, *Athens*.

An experiment involving 168 pigs (6 reps of 3 or 5 pigs/pen) was conducted to determine if feeding a high level of DDGS followed by varying withdrawal periods before slaughter, or if adding a more saturated fat (tallow) to diets containing DDGS (to reduce the dietary U:S fatty acid [FA] ratio) would offset the softer bellies that occur when high levels of DDGS are fed. Treatments (Trt) were (1) a corn-soy diet or (2) a similar diet with 45% DDGS fed to term or removed during the final 2, 4, or 6 wk (Trt 3, 4, 5) followed by the corn-soy diet. Trt 6 and 7 were the same as 1 and 2 except 5% tallow was added. The DDGS analyzed 28% CP, 10% fat, and 0.73% lys. Three diet phases were fed from 38 to 122 kg BW. Diets for Trt 1-5 were formulated on a true ileal digestible (TID) lys basis with 0.83, 0.70, and 0.58% TID lys during the 3 phases. Adjustments were made in diets with fat to maintain the same TID lys:ME ratio as in diets without fat. ADG, but not feed/gain (F/G), was reduced by DDGS inclusion ($P < 0.05$) and ADG improved linearly ($P < 0.05$) with withdrawal time (1.01, 0.93, 0.96, 0.98, 0.98 kg; 2.78, 2.77, 2.82, 3.03, 2.88 for Trt 1-5). ADG increased with tallow addition to the DDGS diet, and F/G improved ($P < 0.01$) with tallow addition to both diets (1.00, 1.00 kg; 2.42, 2.45 for Trt 6 and 7). Backfat and belly fat were obtained from 3 pigs/pen for FA analysis. Flex measures indicated less firm bellies in pigs fed DDGS ($P < 0.01$). Belly firmness increased linearly ($P < 0.01$) with increased withdrawal time, but tallow addition had no positive effect on firmness (lateral flex: 15, 11, 12, 13, 15, 14, 11 cm; vertical flex: 32, 34, 33, 33, 31, 32, 34 cm, respectively). Saturated FA and MUFA in belly fat decreased and PUFA increased when DDGS was fed ($P < 0.01$), and these changes were moderated (linear, $P < 0.01$) with DDGS withdrawal time (e.g., linoleic acid: 12, 22, 18, 17, 15, 11, 21% of total FA). Iodine values followed similar trends (64, 78, 74, 71, 69, 67, 79). The results indicate that withdrawal of a high level of DDGS from the finishing diet for 4 to 6 wk restores carcass firmness, but addition of a harder fat such as tallow does not overcome softer bellies.

Key Words: pig, DDGS, firmness

160 (Invited ASAS Animal Science Young Scholar) Dietary fiber and distillers dried grains with solubles as modulators of pig health. V. Perez* and J. Pettigrew, *University of Illinois*, *Urbana*.

The source of fiber in the diet can modify both microbiota and physical environment of the gut. The direction of those effects is mostly based on the solubility of the fiber and its capacity to be fermented. The soluble fraction of fiber (SOL-F) can be fermented very rapidly. It has been suggested that SOL-F benefits gut health because it promotes the growth of commensal bacteria, which inhibit the growth of pathogens; this concept is known as colonization resistance. Controversially, some disease-challenge studies have shown that inclusion of SOL-F in the diet exacerbates postweaning diarrhea; this negative effect has been related to a greater viscosity of the digesta. In addition, the same studies suggest that low-fiber diets based on rice and animal protein help to reduce postweaning diarrhea. It is not clear, however, whether the contribution from an unknown compound in rice called the rice factor is important or not in that effect. On the other side of the equation, insoluble fiber (INS-F) promotes several physiological effects that are considered to be beneficial for intestinal health, although those studies were conducted in healthy pigs. It is thought that dietary distillers dried grains with solubles (DDGS) may promote pig health. That may be possible because of its large concentration of INS-F, but it lacks of empirical evidence. In a series of disease-challenge studies, we have consistently observed that up to 20% DDGS in the diet does not prevent pigs from *E. coli* infection; however, DDGS appears to delay the shift from commensal to β-hemolytic coliforms in feces and speed the excretion of β-hemolytics. This observation was not followed by a reduction in clinical signs of the disease, but some histological responses suggest a faster recovery as well. The analysis of gut microbial populations suggested that dietary DDGS may promote a more stable and uniform microbiota. Furthermore, dietary supplementation with fiber from cellulose (INS-F), but not from pectin (SOL-F), expedited the recovery from postweaning colibacillosis diarrhea. The inclusion of DDGS or INS-F in the diet is a potential opportunity to promote pig health.

Key Words: DDGS, dietary fiber, postweaning colibacillosis

161 Effect of dried distillers grains with solubles (DDGS) withdrawal regimens on finishing pig performance and carcass traits. J. Y. Jacela*[1], J. M. Benz[1], S. S. Dritz[1], M. D. Tokach[1], J. M. DeRouchey[1], R. D. Goodband[1], J. L. Nelssen[1], and K. J. Prusa[2], [1]*Kansas State University*, *Manhattan*, [2]*Iowa State University*, *Ames*.

A total of 962 pigs (BW = 39 kg) were used to study the effect of DDGS withdrawal regimens on growth performance and carcass traits. Pigs were randomly assigned to 1 of 6 treatments (6 pens/trt) balanced by BW within gender. Treatments were a corn-SBM diet without DDGS fed for 89 d (trt 1), or diets with 0, 15, or 30% DDGS at varying durations during the grow-finish stage (trt 2 to 6; Table 1). There were no treatment × gender interactions ($P > 0.21$) for any criteria and no overall differences ($P > 0.35$) in growth performance among treatments. Final BW numerically decreased as duration of feeding DDGS increased ($P = 0.79$). Feeding DDGS, regardless of amount or duration, had no effect ($P > 0.39$) on carcass traits. Pigs fed DDGS had increased ($P < 0.01$) jowl fat iodine value (IV) compared with trt 1 pigs. When withdrawal duration increased (trt 6, 3, 2, and 1), jowl fat IV decreased (linear; $P < 0.01$). Rate of IV decrease in jowl fat was 0.08 and 0.34 g/100g each wk that DDGS was reduced

to 15 or 0%, respectively. Feed cost/pig was highest ($P < 0.05$) when 0% DDGS was fed or withdrawn 6 wk before marketing (trt 1 and 2) and lowest when DDGS was added in the diets until at least 3 wk before marketing (trt 3 to 6). However, the reduction in feed cost did not improve ($P > 0.57$) income over feed cost. In summary, DDGS reduction or withdrawal 3 or 6 wk before market did not affect growth performance or totally alleviate its negative effect on carcass fat IV.

Table 1.

			DDGS, %				
Treatment:	1	2	3	4	5	6	
d 0 to 48:	0	30	30	30	30	30	
d 48 to 69:	0	0	30	15	30	30	
d 69 to 89:	0	0	0	15	15	30	SEM
BW (d 0), kg	39.0	38.9	39.0	39.5	39.3	38.6	0.96
BW (d 89), kg	121.5	120.9	121.1	119.4	118.7	118.6	1.84
ADG, kg	0.925	0.927	0.920	0.900	0.900	0.907	0.0141
ADFI, kg	2.413	2.428	2.430	2.449	2.398	2.398	0.0436
G:F	0.452	0.497	0.432	0.451	0.512	0.488	0.0184
Yield, %	75.1	75.7	75.9	75.1	75.2	75.7	0.42
Jowl IV, g/100g	68.6	72.6	73.3	74.2	74.6	74.7	0.85
Feed cost, $/pig	44.81	43.45	42.65	42.46	41.56	40.99	0.755
IOFC, $/pig	74.30	77.32	76.88	78.65	76.02	78.86	1.969

Key Words: carcass, DDGS, growth

162 Effects of distillers dried grains with solubles and lactose on growth performance of nursery pigs. H. Tran*, R. Moreno, J. W. Bundy, E. Hinkle, T. E. Burkey, and P. S. Miller, *University of Nebraska*, *Lincoln*.

A 4-wk feeding experiment was conducted to evaluate the effects of distillers dried grains with solubles (DDGS), lactose, and a combination of DDGS with lactose on growth performance of nursery pigs. Ninety six pigs (age, 23 ± 2 d; initial BW, 6.43 ± 0.05 kg) were randomly allotted into each of 16 pens by gender, ancestry, and weight (6 pigs/pen; 4 pens/treatment). In Phase 1 (wk 1 and 2), pigs were fed 1 of the 4 treatments: 1) control (no DDGS and lactose), 2) 15% DDGS, 3) 20% lactose, 4) 15% DDGS + 20% lactose. In Phase 2 (wk 3 and 4), all pigs were fed a common diet containing 15% DDGS and 10% lactose. Diets were formulated to contain 1.47 and 1.42% true ileal digestible Lys in Phase 1 and 2, respectively. There were no DDGS effects on ADG, ADFI, and G:F during Phase 1; however, pigs receiving DDGS compared to no DDGS in Phase 1 had greater ADG (576.2 vs. 534.6 g; $P = 0.05$) and ADFI (814.9 vs. 751.6 g; $P = 0.004$) during Phase 2. Compared to pigs that did not receive lactose in Phase 1, pigs receiving lactose had 21% greater ADG (214.7 vs. 177.2 g; $P = 0.01$), 12% greater G:F (0.741 vs. 0.660 g/g; $P = 0.01$), and a trend for increased ADFI (289.3 vs. 267.6 g; $P = 0.07$) during Phase 1, but decreased ADG (537.7 vs. 573.1 g; $P = 0.09$) during Phase 2. In conclusion, there was no interaction between DDGS and lactose in Phase 1, 2 or the overall experimental period; however, growth performance was maintained when lactose was incorporated in nursery diets containing DDGS.

Key Words: distillers dried grains with solubles, lactose, weanling pig

163 Development of equations to predict the metabolizable energy content of distillers dried grains with solubles (DDGS) samples from a wide variety of sources. O. F. Mendoza*[1], M. Ellis[1], A. M. Gaines[2], M. Kocher[2], T. Sauber[3], and D. Jones[3], [1]*University of Illinois*, *Urbana*, [2]*The Maschhoffs*, *Carlyle, IL*, [3]*Pioneer Hi-Bred*, *Johnston, IA*.

This study was carried out to develop regression equations to predict the ME content of DDGS samples from Midwestern ethanol plants. The ME content of 17 commercial DDGS samples, chosen to represent the variation in nutrient content currently available to the industry, was determined in a metabolism study. Barrows (17.0 ± 0.9 kg BW; n = 18) were fed a corn-based diet (89.5% corn supplemented with 8.0% sodium caseinate, 1.0% limestone, 0.65% dicalcium phosphate, and 0.85% minerals and vitamins) and diets with 50.4% of the corn replaced with each sample of DDGS. An incomplete block design (block = group of 18 crates) was used with the corn and DDGS diets being fed to 36 and 8 pigs, respectively over a 4-d adaptation period followed by a 3-d collection of feces and urine. Gross energy of diets, feces and urine were determined by bomb calorimetry. The energy values for the corn were 3,891 ± 71.4 kcal DE/kg DM and 3,804 ± 75.0 kcal ME/kg DM and the DE and ME of the DDGS samples were determined by the difference method. Chemical composition (CP, crude fat, crude fiber, ADF, NDF, ash, and starch) of each DDGS sample was analyzed by two commercial laboratories. Equations to predict ME content were developed using the stepwise selection method of the REG procedure of SAS. There was a large range between DDGS samples for GE (5,177 to 5,421 kcal/kg DM; SD 64.4), DE (3,322 to 3,797 kcal/kg DM; SEM 55.0; $P < 0.001$), and ME (3,008 to 3,478 kcal/kg DM; SEM 66.6; $P < 0.001$). The simplest, most accurate equation ($R^2 = 0.90$; residual SD 48.7 kcal/kg DM) to predict the ME content of DDGS was 2,815 + (94.5*crude fat) + (96.2*crude fiber) − (33.2*NDF) − (66.2*ash) + (25.9*starch). The results of this study highlight the considerable variation in energy content of commercially available DDGS sources and provide equations based on chemical analysis to predict this variation.

Key Words: DDGS, prediction equations, metabolizable energy

164 Impact of CLA and ractopamine (Paylean) on growth performance and carcass characteristics in finishing pigs fed either corn distillers dried grains with solubles (DDGS) or corn-soy diets. G. D. Gerlemann*[1], R. B. Hinson[1], D. Pompeu[1], S. N. Carr[2], M. J. Ritter[2], B. R. Wiegand[1], G. L. Allee[1], and R. D. Boyd[3], [1]*University of Missouri*, *Columbia*, [2]*Elanco Animal Health*, *Greenfield, IN*, [3]*The Hanor Company*, *Franklin, KY*.

The objective of this 27 d study was to evaluate the feeding of CLA in conjunction with DDGS and ractopamine (RAC) on growth performance and carcass characteristics. Finishing pigs (n = 1,102; TR4 × C22) with an initial weight of (100.6 ± 1.6kg) were utilized in a 2 × 2 × 2 factorial arrangement via a split-split plot design with the main plot being two diet sources (corn-soy and corn-soy-20% DDGS), the split plot being two levels of RAC (0 and 7.4 ppm), and the split-split plot being two levels of CLA (0 and 0.6%). Pen was the experimental unit, with 6 replicates/trt for a total of 48 pens with 23 pigs/pen. Pen weights and feed disappearance were collected on d 0 and 27. On d 27, intact pens were marketed to a commercial slaughter facility to obtain carcass characteristics. Data were analyzed using the PROC Mixed model of SAS. The model included the fixed effects of diet source, RAC, and CLA and all