637 Growth and physiological responses of growing pigs to co-fermented wheat and corn distillers dried grains with solubles. D. Ayoade*, E. Kiarie, B. Slominski, and CM Nyachoti, *University of Manitoba, Winnipeg, Manitoba, Canada.*

Gaining a detailed knowledge on the impact of a feedstuff on pig growth and physiological responses is critical for its effective utilization in swine nutrition. Thus, the purpose of this study was to investigate the effect of distillers dried grains with solubles derived from co-fermentation of wheat and corn (wcDDGS) on performance, carcass and viscera organ weights, whole body O_2 consumption and heat production (HP) in growing barrows. The experimental diets were: (1) corn-soybean meal diet (Basal) (2) Basal + 15% wcDDGS, and (3) Basal + 30% wcDDGS. All diets were formulated to meet the NRC 1998 nutrients specification for 20–50 kg pigs. In Exp. 1, 48 pair-housed pigs (18.5 kg BW) were alloted based on BW to the 3 diets (n = 8). Pigs had free access to water and feed for a 28-d period during which ADG and ADFI were monitored weekly. On d 28, 1 pig/pen was killed to measure carcass and viscera organ weights. Overall, wcDDGS linearly decreased ($P < 0.001$) ADFI and ADG but had no effect on G:F ($P > 0.10$). The ADFI was 3.1, 2.9 and 2.7 kg/d for diets 1, 2 and 3, respectively; corresponding values for ADG were 0.79, 0.75 and 0.67 kg/d. A linear decline ($P = 0.04$) in eviscerated hot carcass weight was observed as wcDDGS increased, specifically, pigs fed 30% wcDDGS had 11.2% lower carcass weight relative to the pigs fed the basal diet. However, diet had no effect ($P > 0.10$) on the weights of any of the viscera organs. In Exp. 2, 18 pigs (20.4 kg BW) individually housed in metabolism crates were fed the 3 diets (n = 6) at 550 kcal ME/kg $BW^{0.60}$/d for a 15-d period followed by measurement of O_2 consumption and CO_2 production over a 24-h period using an indirect calorimeter system. There was no effect of diet ($P > 0.10$) on whole body O_2 consumption and CO_2 production and HP. In conclusion, increasing wcDDGS content in growing pig diets linearly reduced ADFI, ADG, and eviscerated hot carcass weight but had no effect on G:F, viscera organ weights and heat production.

Key words: co-fermented wheat and corn DDGS, physiological responses, pigs

638 High-protein distillers dried grains can replace soybean meal in the diets for growing-finishing pigs. L. Ma*[1] and G. Allee[2], *[1]Chia Tai Investment Co., Ltd., Beijing, China, [2]University of Missouri, Columbia.*

The information on the use of high-protein distillers dried grains (HP-DDG) to replace soybean meal (SBM) in swine diets is limited. Additionally, previous studies from our lab determined that the optimal SID Trp:lys ratio of pigs fed diets containing HP-DDG was 16%. Thus, the objectives of this study were to determine the effects of HP-DDG replacing SBM in grower-finisher diets on growth performance and to evaluate the validity of 16% SID Trp:Lys ratio for pigs. Pigs (n = 108; initial BW = 29.1 kg) were blocked by BW and allotted to one of 3 dietary treatments: 1) Corn-SBM control diet, 2) diet with HP-DDG replacing 37% of SBM, 3) diet with HP–DDG replacing 70% of SBM, in a 4-phase study (21 d/phase). Each treatment had 6 replicate pens with 6 pigs per pen. In this study, the SID Trp:Lys ratios of the control diets were above 17%. The diets including HP–DDG contained SID Trp:Lys ratios of 16%. In phase 4 (99–123 kg), ractopamine (Paylean, Elanco Animal Health) was added in the diets. At the beginning and the end of each phase, pigs were individually weighed and feed disappearance was recorded. There were no differences in ADG, ADFI, and G:F ($P > 0.05$) during any phase and the entire 84 d among the 3 treatments. In conclusion, HP–DDG (35.5% CP) can be used to replace up to 70% of SBM in growing-finishing pigs diets without any detrimental impact on performance. In addition, 16% SID Trp:Lys ratio is suitable for growing-finishing pigs fed diets containing HP–DDG.

Table 1.

	Control	2	3	SE	*P*-value
D 0 WT, kg	29.13	29.00	29.37	0.66	0.65
D 84 WT, kg	124.94	123.52	124.04	1.36	0.56
D 0 to 84					
ADG, kg	1.14	1.13	1.13	0.01	0.61
ADFI, kg	3.05	3.01	3.03	0.06	0.85
G:F	0.37	0.37	0.37	0.003	0.83

Key words: high-protein distillers dried grains, pigs, growth performance

639 Effects of including tallow, palm kernel oil, corn germ, or glycerol to diets containing distillers dried grains with solubles on pork fat quality of growing-finishing pigs. J. W. Lee*, B. D. Keever, J. Killefer, F. K. McKeith, and H. H. Stein, *University of Illinois, Urbana.*

Thirty 6 barrows and 36 gilts (initial BW: 43.7 ± 2.0 kg) were used in an 88-d experiment to determine effects of including tallow, palm kernel oil, corn germ, or glycerol to diets containing distillers dried grains with solubles (DDGS) on pork fat quality of growing-finishing pigs. Pigs were individually housed and randomly allotted to 1 of 6 dietary treatments using a 2 × 6 factorial design with 2 genders and 6 diets and 12 replicate pigs per diet. A corn-soybean meal control diet with no added fat and a diet containing corn, soybean meal, and 30% DDGS were formulated. Four additional diets were formulated by adding 15% corn germ, 3% tallow, 3% palm kernel oil, or 5% glycerol to the DDGS-containing diet. At the end of the experiment, pigs were slaughtered, belly characteristics were measured, and backfat and belly fat samples were collected. Fatty acids were analyzed in all ingredients, diets, and fat samples, and iodine value (IV) was calculated. Dietary IVP was calculated using either the sum of the analyzed IVP of each ingredient in the diet (IVP 1) or the analyzed IVP of dietary fat (IVP 2). There were no effects of diet on belly length, width, and weight. Pigs fed the control diet had greater ($P < 0.05$) flop distance than pigs fed the DDGS-containing diets. There were no differences in flop distance among the diets containing DDGS. Barrows had greater ($P < 0.05$) flop distance and heavier ($P < 0.05$) bellies than gilts. Diet did not affect belly fat IV. However, gilts had greater ($P < 0.05$) belly fat IV than barrows. Dietary IVP 1 was positively correlated (r = 0.80; $P = 0.06$) to backfat IV; however, there was no correlation with belly fat IV. Dietary IVP 2 was not correlated with either backfat or belly fat IV. Back fat IV can be predicted using the following equation: IV = 0.11 × dietary IVP 1 + 70.29 (R2 = 0.63, $P < 0.06$). In conclusion, the negative effects of DDGS on pork fat quality were not ameliorated by supplementing diets with corn germ, tallow, palm kernel oil, or glycerol.

Key words: fat quality, DDGS, pigs

640 The impact of feeding corn distillers dried grains with solubles to sows on plasma and milk vitamin E and selenium levels. S. A. Crowder* and M. E. Johnston, *JBS United Inc., Sheridan, IN.*

Corn distillers dried grains with solubles (DDGS) were fed to gestating and lactating sows to determine the impact on milk and plasma vitamin E (vit E) and selenium (Se) levels. One hundred thirty-eight sows (PIC-C29) were blocked by parity and body condition score and allotted to 1 of 4 treatments. Diet 1 (Control) contained 0% DDGS in gestation and lactation, diet 2 contained 15% DDGS in gestation and 7.5% DDGS in lactation, diet 3 contained 30% DDGS in gestation and 15% DDGS in lactation. Diets 1, 2, and 3 were formulated to contain 66 IU/kg of vit E. Diet 4 contained 15% DDGS in gestation and 7.5% DDGS in lactation with supplemental vit E (110 IU/kg total). Plasma samples were collected from sows on d 100 of gestation and at weaning. Milk samples were collected from sows and plasma samples from a subset of pigs at weaning. All samples were analyzed for vit E and Se levels. Sow performance was not affected by the inclusion of DDGS with or without added vit E; including number of pigs born live and weaned, birth and wean weight, and lactation feed intake ($P > 0.05$). There was no negative impact of DDGS inclusion with or without added vit E on plasma Se levels at d 100, weaning, in the pig, or the milk. There was no negative impact of DDGS inclusion on sow plasma vit E levels at d 100 (Control = 1.69 μg/ml, 15% DDGS = 1.90 μg/ml, 30% DDGS = 2.10 μg/ml, 15% DDGS + vit E = 2.35 μg/ml) or at weaning. Milk vit E levels for Control, 15% DDGS, 30% DDGS, and 15% DDGS + vit E were 3.57, 3.24, 3.35, and 3.90 μg/ml respectively. There was no difference in milk vit E level between the Control and the DDGS treatments ($P > 0.05$). The 15% DDGS + vit E had a higher milk vit E level ($P < 0.05$) compared with the 15% and 30% DDGS treatments. Pig vit E level was greatest for the 15% DDGS + vit E treatment ($P < 0.05$). There was no difference in pig vit E level between the Control and DDGS without added vit E treatments ($P > 0.05$). These data suggest the addition of up to 30% DDGS in gestation and 15% DDGS in lactation diets with 66 IU/kg of vit E had no negative impact on vit E and Se levels.

Key words: sow, DDGS, vitamin E

641 Evaluation of various corn distillers dried grains with solubles (DDGS) feeding strategies in nursery pigs. N. L. Horn*, C. R. Little, and J. D. Spencer, *JBS United Inc., Sheridan, IN.*

An experiment was conducted to determine the performance response of nursery pigs fed various corn DDGS feeding strategies. There were 11 replicates per treatment with 11 pigs per pen. Four hundred and eighty-four pigs (PIC C29 × 337, BW = 6.21 ± 0.16 kg, 19-d old) were blocked by gender and BW, and pigs within each block were randomly assigned to one of 4 dietary treatments. Pigs were fed a 4-phase nursery program with a common phase 1 pellet containing no DDGS from d 1 to 6 post wean and the phase 2, 3, and 4 experimental diets from d 7 to 13, d 14 to 20, and d 21 to 41 post wean, respectively. Dietary treatments were 1.) No DDGS throughout, 2.) 0, 10, and 20% DDGS d 7 to 13, d 14 to 20, and d 21 to 41 post wean, respectively (slow step-up), 3.) 10, 20, and 30% DDGS d 7 to 13, d 14 to 20, and d 21 to 41 post wean, respectively (moderate step-up), and 4.) 20 and 30% DDGS d 7 to 13 and d 14 to 41 post wean, respectively (aggressive step-up). Experimental diets were formulated to contain equivalent true ileal digestible lysine (1.36%) during phases 2 and 3 and an equivalent true ileal digestible lysine to ME ratio (3.75) during phase 4. Introducing DDGS to pigs in phase 2 did not affect ($P > 0.05$) growth performance. DDGS supplementation in phase 3 increased ($P < 0.05$) ADG and G:F compared with the no DDGS program. Furthermore, 20 and 30% DDGS supplementation increased ($P < 0.05$) ADFI compared with the no DDGS program during phase 3. In phase 4, the pigs fed the aggressive DDGS program gained less weight ($P < 0.05$) than the other dietary treatments. Cumulatively (6 wk), use of DDGS in diets for nursery pigs had no effect ($P > 0.05$) on final BW or ADG, but did result in reduced ($P < 0.05$) feed intakes and increased ($P < 0.05$) G:F, with no difference among the DDGS utilization strategies. These results suggest that 20% DDGS can be used as early as 7-d post weaning and up to 30% DDGS by 14 d post weaning without negatively affecting growth performance; however, all these results will depend on DDGS quality and accurate characterization of nutrient values.

Key words: DDGS, nursery, swine

642 Effects of distillers dried grains with solubles in the diet of gestating sows on nutrient excretion. H. J. Kim*, S. D. Carter, T. M. Walraven, M. R. Bible, and K. F. Coble, *Oklahoma State University, Stillwater.*

A total of 88 sows (212 kg; parity = 2.5) were used to determine the effects of distillers dried grains with solubles (DDGS) on nutrient excretion during the gestation period. Sows were stratified by BW, parity, and status of gestation, and housed in one of 2 identical environmentally-controlled buildings (experimental unit) with shallow pit, pull-plug systems. Dietary treatments were randomly assigned to one of 2 buildings in a 2 (trt) x 2 (building) crossover design. The control diet consisted of a fortified corn-soybean meal based diet formulated to 12% CP, 0.47% SID Lys and 0.39% digestible P. The experimental diet (DG40) contained 40% DDGS (89.2% DM, 26.1% CP, 0.8% P, and 2.2 ppm DON) and was formulated to 16% CP, 0.47% SID Lys and 0.39% digestible P. DDGS replaced corn, soybean meal and dicalcium phosphate and Lys HCl was used to adjust dietary levels of CP and SID Lys. Each of 2 phases consisted of a 6-wk period which included a 2-wk adjustment period followed by a 4-wk slurry collection period. At the end of the initial 6-wk period, treatments were switched between buildings to allow for another 6-wk period. There was no difference ($P > 0.10$) in feed intake (2.28 vs. 2.20 kg) for sows fed control vs. DG40. Also, slurry pH (7.66 vs. 7.65), temperature (16.6 vs. 17.2°C), and volume (38.4 vs. 42.7 L) were similar ($P > 0.10$). Daily intakes of DM, P, Ca, K, Fe, Zn, Cu, and Mn were similar ($P > 0.10$) for both dietary treatments. However, daily N intake (46 vs. 55 g) tended to increase ($P = 0.10$), but Mg (3.1 vs. 4.5 g), Na (4.8 vs. 7.5 g), and S (4.1 vs. 7.6 g) intake increased ($P < 0.05$) for sows fed 40% DDGS. Inclusion of DDGS in the diet increased ($P = 0.04$) daily excretion of DM (199 vs. 255 g) and S (2.7 vs. 4.4 g) by 28 and 68%, respectively. The daily excretion of Ca and Mg tended to increase ($P < 0.08$) with DDGS. Daily N excretion increased by 20% with inclusion of DDGS in the diet; however, this was not significant ($P = 0.12$). In conclusion, 40% inclusion of DDGS in the diet of gestating sows markedly increases DM and S excretion, and may influence N, Ca, and Mg excretion. This work was partially funded by NPB.

Key words: Sows, DDGS, nutrient excretion