

CLA (BTCLA1), or 10% beef tallow from cows fed 2.5% CLA (BTCLA2.5) for 18 days. Hens were artificially inseminated weekly. Eggs were collected daily, stored at 15C for 24 hrs, and then incubated. Some unincubated eggs were stored at 4C or 21C for 30 days and analyzed for pH and fatty acid content. After the 8th day of feeding CLA alone, embryonic mortality of fertile eggs was 100% versus 7, 9, 5, 6, and 7% in CO, BT, CLA+BT, BTCLA1, and BTCLA2.5, respectively. Total CLA levels of yolk from CO, CLA, BT, CLA+BT, BTCLA1, and BTCLA2.5 were 0, 2.13, .91, 1.56, 1.1, and 1.2%, respectively. CLA and CLA+BT significantly increased C16:0, C18:0 and decreased C16:1(n-7) and C18:1(n-9). Eggs from group BTCLA1 or BTCLA2.5 did not have increased C16:0 and C18:0 or decreased C18:1(n-9) compared to CO. Arachidonic acid content of yolk was significantly reduced by CLA compared to CO. Yolk pH increased and albumen pH decreased in the egg from CLA group relative to CO (8.09 and 8.63 versus 6.13 and 9.04, respectively) when stored at 4C for 30 days. Feeding CLA also caused discoloration of yolk and albumen when whole eggs were stored at 4C for 30 days. Abnormal pH changes and discoloration did not develop in the yolk and albumen of the eggs from CO, BT, CLA+BT, BTCLA1 and BTCLA2.5. These results suggested that beef tallow from cows fed CLA or beef tallow supplemented with CLA had no adverse effect on hatchability or egg quality when fed to laying hens.

Key Words: Beef tallow, Conjugated linoleic acid, hatchability

159 Effect of betaine on growth, carcass traits, and pork quality of finishing pigs. J. O. Matthews*, L. L. Southern, A. D. Higbie, M. A. Persica, and T. D. Bidner, *LSU Agricultural Center.*

An experiment was conducted to determine the effect of dietary betaine (0, .125, .250, or .500%) on growth, carcass traits, pork quality, and tissue betaine concentrations of crossbred finishing pigs. Four replications of three pigs (two barrows and one gilt) each were used. The basal diet contained .85 (69 to 88 kg BW) or .65% Lys (88 to 115 kg BW). Overall ADG and gain:feed were not affected ($P > .10$) by betaine, but overall ADFI was decreased (quadratic, $P < .02$; 0 vs betaine, $P < .01$) by betaine, with pigs fed .250% betaine having the lowest ADFI. Loin muscle area, average backfat, dressing percentage, percentage lean, total fat, lean:fat, and leaf fat weight were not affected ($P > .10$) by betaine. Tenth rib 3/4 backfat thickness was decreased (quadratic, $P < .05$; 0 vs betaine, $P < .02$) in pigs fed betaine. Carcass length was increased (linear, $P < .03$; 0 vs betaine, $P < .06$) as the level of betaine was increased. Fat-free lean, lean gain per day, ham weight, ham fat-free lean, and ham percentage lean were increased (quadratic, $P < .06$) in pigs fed .250% betaine, but percentage fat, total ham fat, percentage ham fat, and butt fat thickness were decreased (quadratic, $P < .06$) in pigs fed .250% betaine. Purge loss and 24 h pH were increased (quadratic, $P < .10$; 0 vs betaine, $P < .02$) and cooking loss was decreased (linear, $P < .03$) in pigs fed betaine. The Minolta L^* value for the *biceps femoris* was decreased (quadratic, $P < .06$; 0 vs betaine, $P < .09$), with pigs fed .250% betaine having the lowest L^* value. Subjective color, firmness-wetness, and marbling, and percentage moisture and bound water of the longissimus muscle, and shear force were not affected ($P > .10$) by betaine. Betaine was not detectable ($< .07$ mg/g) in the longissimus muscle of pigs fed 0% betaine, but betaine was detectable and relatively constant in pigs fed .125, .250, or .500% betaine (.22, .17, and .21 mg/g respectively). Betaine improved carcass traits when provided at .250% of the diet and improved some aspects of pork quality.

Key Words: Pigs, Betaine, Pork Quality

160 Margins of safety can be lowered for supplemental copper, zinc, iron, and manganese in finishing pig diets. B. W. James*, S. S. Dritz, M. D. Tokach, R. D. Goodband, and J. L. Nelssen, *Kansas State University, Manhattan.*

Growth performance and carcass characteristics were evaluated on 1,100 barrows (PIC C-22 x 337) to determine the effects of reducing supplemental Cu, Zn, Fe, and Mn concentrations during the finishing phase. Pigs (initially 46 kg) were sorted by weight in a randomized complete block design to one of four dietary treatments with 11 pens/treatment. Weights and feed intake were obtained biweekly. Pigs were marketed at an average of 115 kg BW. Measurements of carcass weight, fat depth, loin depth, lean percentage, and fat free lean index (FFLI) were obtained. Corn-soybean meal based diets were formulated in four phases (46 to 71 kg, 71 to 95 kg, 95 to 106 kg, and 106 to 115 kg) with 1.05, .83, .72, and .62% total lysine, respectively. Supplemental selenium and iodine were provided at .3 ppm for the first phase and .2 ppm for the

three remaining phases. All other nutrients met or exceeded the requirement estimates provided by NRC (1998). Vitamin levels were similar to current industry recommendations. Supplemental Cu, Zn, Fe, and Mn were provided in the control diet at 16.5, 165, 165, and 39.6 mg/kg (3 to 5 times NRC) during phase 1, and 11, 110, 110 and 26.4 mg/kg during phase 2, 3, and 4. Treatments 2 and 3 provided 50 and 25%, respectively, of the supplemental trace minerals included in the control diet while treatment 4 provided 50% during phase 1 and no supplemental trace minerals in the last three phases. Overall ADG (.76, .78, .78, and .77 kg/d), feed efficiency (.37, .38, .38, and .37), FFLI (49.1, 49.0, 49.1, and 49.1), or other growth and carcass criteria were not influenced ($P > .10$) by dietary treatment. These results suggest that margins of safety for Cu, Zn, Fe, and Mn can be lowered significantly in diets fed to terminal-cross finishing pigs without influencing growth performance or carcass traits.

Key Words: Trace minerals, Growth, Carcass characteristics

161 Biological role of pantothenic acid in the pig. T. S. Stahly and T.R. Lutz*, *Iowa State University, Ames.*

D-calcium pantothenate (0, 10.8, 21.6 ppm) was added to a basal diet to create three dietary concentrations of bioavailable pantothenic acid (PA; analyzed values corrected for bioavailability of 3.2, 13.6, 26.7 ppm). Pigs (10 sets of 3 littermates/strain) from moderate and high lean strains with respective BW gain contents of 17.2 and 17.6% protein and 11.5 and 9.8% fat were individually penned, and self-fed the basal diet (all vitamins except PA at 600% NRC, 1998) from weaning (12 d of age) to 10 kg BW. Pigs were then allotted within litter to one of three PA concentrations and fed their respective diets from BW ($\pm .3$ kg) of 10 to 27 kg to determine the biological role and utilization of PA in pigs. A fourth pig in each litter was killed at 10 kg BW for determination of initial body composition. Total body PA was initially $44 \pm .7$ mg in both strains and at 27 kg BW increased linearly (117, 160, 181 mg; $P < .01$) as dietary PA increased. Using regression analysis, endogenously synthesized PA was estimated as 2.85 mg/ BW kg^{.75}/d. The gross efficiency of retention of PA (diet and endogenous) was estimated as 10.5% and was independent of diet. As dietary PA increased, daily BW gain (679, 688, 684 g) and energy retention (1.37, 1.35, 1.35 Mcal) were not altered. But dietary PA additions improved feed/gain ratios (1.44, 1.43, 1.40; $P < .12$), increased protein content of BW gain (17.34, 17.46, 17.48%; $P < .01$) and decreased fat content of BW gain (11.15, 10.43, 10.36%; $P < .01$) resulting in a greater protein/fat ratio in BW gain (1.58, 1.71, 1.73; $P < .03$) with the magnitude of the responses being greater ($P < .05$) in the moderate lean strain. Daily PA intake, mg/BW kg^{.75}, was positively and negatively related to the amounts of dietary energy deposited as body protein and fat, respectively. Based on these data, PA in amounts above that needed to support body energy retention has a biological role in regulating body composition particularly in physiological states of high fat deposition.

Key Words: Pantothenic Acid, Body Composition, Pigs

162 Food-grade sorghum in diets for nursery pigs. D. W. Dean*, J. D. Hancock, R. H. Hines, L. J. McKinney, K. C. Behnke, and D. J. Lee, *Kansas State University, Manhattan.*

A total of 180 weanling pigs (6.1 kg average initial BW) were used to determine the effects of food-grade sorghum on growth performance. The pigs were blocked by weight and allotted to pens based on sex and ancestry. There were six pigs per pen and six pens per treatment. Treatments were mill-run corn, a bronze-pericarp sorghum hybrid (Pioneer 8500), and three food-grade (white seed/tan plant) sorghums (NC+ 7W97, Cargill 888Y, and Jowar 1) ground through a hammermill (1.6 mm screen) to a mean particle size of approximately 500 microns. Cargill 888Y and Jowar 1 were normal for starch type while NC+ 7W97 was heterowaxy. Corn- and sorghum-based diets were formulated using kg/kg substitutions. The sorghums required less net energy to grind with greater production rates ($P < .001$) than corn. The NC+ hybrid required less energy to grind ($P < .001$) with greater production rate ($P < .02$) than the other food-grade hybrids. For the pig experiment, there were no differences in rate or efficiency of gain among pigs fed corn versus the sorghums ($P > .7$), bronze versus food-grade sorghums ($P > .5$), and heterowaxy versus normal starch type sorghums ($P > .2$). However, gain/feed tended to be greater ($P < .1$) for Jowar 1 versus Cargill 888Y. In conclusion, our results suggest that hammermill production rate can