

**130 Determining the optimal threonine:lysine ratio in starter diets for the segregated early-weaned pig.** J. R. Bergstrom\*, J. L. Nelssen, M. D. Tokach, R. D. Goodband, K. Q. Owen, W. B. Nessmith, Jr., *Kansas State University, Manhattan.*

Two experiments were conducted to determine the threonine:lysine ratio necessary to optimize growth performance of the segregated early-weaned (SEW) pig. In Exp. 1, 360 pigs (PIC, C15 x 326) were weaned at  $14 \pm 2$  d of age, blocked by weight (initially  $4.5 \pm .5$  kg), and allotted to each of twelve dietary treatments, with 5 pigs/pen and 6 pens/treatment. The twelve experimental corn-soybean meal diets were formulated to contain either 1.15 or 1.5% apparent digestible lysine. L-threonine was substituted for corn starch to provide six digestible threonine:lysine ratios (50, 55, 60, 65, 70, and 75%) within each lysine level in a  $2 \times 6$  factorial arrangement. Other essential amino acids were calculated to exceed estimates suggested by the University of Illinois ideal ratio on an apparent digestible basis. No lysine x threonine interactions were observed. During the entire 21 d trial, ADG and feed efficiency (G/F) were improved ( $P < .01$ ), and d 14 plasma urea N (PUN) was increased ( $P < .01$ ), by feeding 1.5% digestible lysine. Threonine ratio had no effect on the response criteria. In Exp. 2, 300 pigs (Newsham Hybrids) were weaned at  $14 \pm 2$  d of age, blocked by weight (initially  $4.5 \pm 1.0$  kg), and allotted to each of twelve dietary treatments, with 5 pigs/pen and 5 pens/treatment. Pigs were fed either 1.15 or 1.5% apparent digestible lysine with digestible threonine:lysine ratios of 40, 45, 50, 55, 60, and 65%. No interactions were observed. From d 0 to 14, ADG and G/F were improved ( $P < .01$ ), and d 14 PUN was increased ( $P < .01$ ), by feeding 1.5% digestible lysine. Average daily gain decreased (linear,  $P < .01$ ) as the threonine ratio increased, with pigs fed 40 to 50% digestible threonine having the highest ADG. Increasing the threonine:lysine ratio decreased (quadratic,  $P < .05$ ) d 14 PUN, with pigs fed 45% digestible threonine having the lowest PUN. These data suggest that the digestible threonine requirement is no more than 45% of lysine for the high-lean growth SEW pig.

**Key Words:** Pigs, Amino Acids, Threonine

**131 Determining the optimal threonine:lysine ratio in diets for the phase III nursery pig.** J. R. Bergstrom\*, J. L. Nelssen, M. D. Tokach, R. D. Goodband, K. Q. Owen, B. T. Richert, W. B. Nessmith, Jr., J. A. Loughmiller, S. S. Dritz, *Kansas State University, Manhattan.*

Two hundred and sixty pigs (Newsham Hybrids) were used in a 21 d growth trial to determine the optimal threonine:lysine ratio necessary to maximize growth performance of the 11.4 to 22.7 kg nursery pig. Pigs were blocked by weight (initially  $11.0 \pm .8$  kg) and allotted to each of ten dietary treatments for 21 d, with 4 or 5 pigs/pen (depending upon the block) and 6 pens/treatment. The ten experimental corn-soybean meal diets were formulated to provide either .75 or 1.1% apparent digestible lysine. Five digestible threonine:lysine ratios (40, 47.5, 55, 62.5, and 70%) within each lysine level provided a  $2 \times 5$  factorial arrangement. The various threonine ratios were achieved by substituting L-threonine for corn starch. Synthetic amino acids were included to ensure that all diets contained all other essential amino acids as suggested by the University of Illinois ideal ratio on an apparent digestible basis. From d 0 to 21, ADG and feed efficiency (G/F) were improved ( $P < .0001$ ), and d 14 plasma urea nitrogen (PUN) was increased ( $P < .0001$ ), by feeding 1.1% digestible lysine. Average daily gain and G/F were improved (linear,  $P < .003$ ; quadratic,  $P < .03$ ) by increasing the threonine:lysine ratio, with pigs fed 55% digestible threonine having the highest ADG and G/F. A lysine x threonine interaction ( $P < .02$ ) was observed for ADFI, with pigs fed .75% digestible lysine having increased ADFI, and pigs fed 1.1% digestible lysine having decreased ADFI, when the digestible threonine:lysine ratio was increased from 40 to 70%. Increasing the threonine:lysine ratio decreased (linear,  $P < .0001$ ; quadratic,  $P < .007$ ) d 14 PUN, with pigs fed 62.5% digestible threonine having the lowest PUN. These data suggest that the optimum digestible threonine:lysine ratio is approximately 55% of lysine for the high-lean growth, phase III nursery pig.

**Key Words:** Pigs, Amino Acids, Threonine

**132 Substitution of lactose and amino acids for whey in the diets of pigs weaned at 10 days.** C. Robert Dove<sup>1</sup>\* and James Usry<sup>2</sup>, <sup>1</sup>Univ. of Georgia, Tifton, <sup>2</sup>Heartland Lysine, Chicago.

A study was conducted using 192 pigs weaned at 10 days of age. Pigs were randomly allotted to one of four dietary treatments within litter outcome group. There were two trials and three replicates within each trial. Pigs were housed eight/pen in an environmentally controlled room for the first 21 days of the study and then in an environmentally controlled nursery for the remainder of the 42 day study. Pigs had ad libitum access to feed and water throughout the trial. Experimental diets were formulated to contain 0, 5, 10, or 20% whey during the first 10 days (phase I) of the trial and then 0, 2.5, 5 or 10% whey for days 11 to 21 (phase II) of the trial. Lactose was substituted for whey so that all diets contained similar levels of lactose. Amino acids were added to the diet so that lysine, tryptophan, threonine, total sulfur amino acids and isoleucine met or exceeded an ideal protein ratio. All pigs were fed a common diet days 21 to 42 that contained 5% whey (phase III). During phase I and II pigs fed the diets containing whey had increased ADG ( $P < .01$ ) and ADFI ( $P < .001$ ) compared to the diet containing 0% whey. The addition of whey to the diet had no effect on feed efficiency ( $P > .10$ ). For the combined period of phase I and II, ADG was 117, 162, 160, and 156 g/d and ADFI was 180, 238, 242, and 235 g/d for the 0, 5, 10 and 20% whey diets respectively. During phase III previous dietary treatment had no effect ( $P > .1$ ) on ADG, ADFI or feed efficiency. Over the entire 42 day trial, the addition of whey to the diet increased ( $P < .05$ ) ADG and ADFI, but had no effect on feed efficiency. There were no differences ( $P > .1$ ) in performance due to the varying levels of whey in the diet. These data indicate that lactose and amino acids can be substituted for whey in the diets of early weaned pigs for all but 5% of the whey in the diet.

**Key Words:** Lactose, Early Weaning, Whey, Amino Acids

**133 Interactions between lactose, spray-dried plasma protein, and soybean meal in diets for segregated early-weaned pigs (SEW).** W. B. Nessmith Jr., M. D. Tokach, R. D. Goodband, J. L. Nelssen, J. R. Bergstrom, and K. Q. Owen., *Kansas State University, Manhattan.*

Two experiments were conducted to determine the interactions between lactose and protein sources in diets for SEW pigs. Diets consisted of three levels of pure lactose (0, 20, and 40%), two levels of spray-dried plasma protein (SDPP; 0 or 7.5% in Exp. 1; 0 or 7% in Exp. 2), and two levels of soybean meal (SBM; 0 and 20%) in a  $3 \times 2 \times 2$  factorial arrangement. The experimental diets were formulated to 1.7% lysine and fed from d 0 to 14 in Exp 1 and d 0 to 10 in Exp 2. In Exp 1, 360 barrows (initially 5.3 kg and 19 d  $\pm 2$  d) were blocked by BW with 6 replications/treatment. Pigs were fed common diets in phase II (d 14 to 28, 1.35% lysine) and phase III (d 28 to 34, 1.3% lysine). Pigs fed diets containing SDPP had increased ( $P < .05$ ) ADG and ADFI from d 0 to 14. There was a SBM by lactose interaction observed for ADG ( $P < .05$ ) and ADFI ( $P < .10$ ). When pigs were fed diets containing SBM, increasing lactose resulted in a greater increase ADG and ADFI compared with those pigs fed diets without SBM. From d 14 to 28, ADFI was decreased if SDPP and SBM were included in the diet from d 0 to 14 (SDPP by SBM interaction,  $P < .10$ ). For the overall trial (d 0 to 34), ADG and ADFI were increased ( $P < .05$ ) for pigs fed SBM from d 0 to 14 compared to pigs fed diets without SBM. In Exp 2, 324 barrows (initially 3.7 kg and 10 d  $\pm 2$  d) were blocked by BW with 5 replications/treatment. A common transitional diet, formulated to 1.45% lysine and containing 2.5% SDPP was fed from d 10 to 17. Pigs were fed a common phase II diet (d 17 to 26, 1.3% lysine). From d 0 to 10, increasing lactose improved (linear,  $P < .05$ ) ADG and ADFI while pigs fed SDPP had higher ADFI ( $P < .05$ ). In conclusion, these data suggest adding SBM to the diet from d 0 to 14 postweaning did not adversely effect ADG, and increasing lactose improved growth performance of the SEW pig. In addition, SDPP improved growth performance in the first phase of both trials.

**Key Words:** SEW, Lactose, Spray-dried plasma protein