

**620** The effects of branched chain amino acids on sow and litter performance. S. A. Moser\*, R. D. Goodband, M. D. Tokach, and J. L. Nelssen. *Kansas State University, Manhattan.*

Three hundred-six (n = 36 to 41) sows (PIC, L C-19) were used to evaluate the interrelationship between leucine (Leu), isoleucine (Ile) and valine (Val) on sow and litter performance. Eight dietary treatments were arranged as a 2x2x2 factorial with 2 levels of Val (.70 and 1.10%), Ile (.85 and 1.25%) and Leu (1.55 and 1.95%) and TBCAA levels of 3.1, 3.5, 3.9 and 4.30%. The lowest level of each amino acid is similar to the respective levels in a .90% lysine corn-soybean meal diet containing 15% L-lysine HCl. Amino acids other than Leu, Ile and Val were at least 110% of their suggested estimate relative to lysine. Average number of pigs on d 2 was 11.2, and average lactation length was 20.9 d. Number of pigs weaned ( $\bar{x}$  = 10.6), sow ADFI ( $\bar{x}$  = 5.85 kg), and sow weight loss ( $\bar{x}$  = 4.25 kg) were not affected by dietary treatment (P > .10). Sow backfat loss (.92 vs. 1.57 mm) and litter weaning weight (LWWT) increased (P < .04) as dietary Val increased. Litter weight gain (LWG) from d 2 to weaning (WN) increased (P < .05) as dietary Val increased. Litter weight at weaning and LWG were not affected by dietary Ile (P > .80) and Leu (P > .60). These results confirm the importance of dietary valine for increased litter weaning weight, independent of either additional dietary leucine or isoleucine concentrations.

	Val%		Ile%		Leu%		TBCAA %	
	.70	1.10	1.55	1.95	1.55	1.95	3.10	3.50
ADG d 2 to WN, kg	42.3	43.0	42.3	43.3	45.2	43.3	44.3	44.9
LWWT kg	61.6	63.0	61.5	63.1	65.0	62.7	64.7	64.9

Key Words: Valine, Leucine, Isoleucine

68 vs 1.08  
80 vs 1.20

**621** Limiting amino acid requirements of lactating sows estimated by plasma arterio-venous difference of free amino acids across the mammary gland. X. F. Guan\*<sup>1</sup>, P. K. Kul\*, J. E. Pettigrew<sup>2</sup>, N. K. Ames<sup>1</sup>, R. J. Tempelman<sup>1</sup>, and N. L. Trotter<sup>1</sup>. <sup>1</sup>Michigan State University, Lansing, <sup>2</sup>University of Minnesota, St. Paul.

Twelve sows (Landrace x Yorkshire; BW = 214.2 ± 18.8 kg; parity 2 or 3) were used to estimate lysine, threonine and valine requirements during lactation by plasma arterio-venous (A-V) differences of free plasma amino acids (AA) across the mammary gland. Each sow nursing 11 pigs was provided ad libitum access to 1 of 4 diets (3 sows/diet). The 4 diets contained the same ME (3.4 Mcal/kg) and AA ratios, but different CP concentrations (7.8, 13.0, 18.2 and 23.5%). Sows were fitted with carotid arterial and main mammary venous catheters on d 4 or 5 of lactation. On d 10, 14, 18, and 22 of lactation, arterial and venous blood were collected simultaneously every 30 min for 6 h. Pooled daily plasma samples were used for AA analysis. Sows had an average BW loss of 23.0 kg and nursed litters with an ADG of 2.02 kg during a 21-day lactation period. The relationship between log AA A-V difference and daily AA intake (g/d) followed a linear and quadratic (P < .05) pattern at different stages of lactation. The best fitting regression model was  $\hat{Y} = aX^2 + bX + c$ , with  $\hat{Y}$  being predicted log AA A-V difference, X daily AA intake (g/d) and a, b and c parameter estimates. Lysine, threonine and valine daily requirements (g/d) were estimated by their maximum A-V difference ( $\hat{Y}_{max}$ ), i.e., when  $X = -b/2a$ . The regression equations for lysine, threonine and valine were  $\hat{Y}_{Lys} = .000955X^2 + .07812X + 2.3229$  ( $R^2 = .5738$ ,  $P = .0330$ ),  $\hat{Y}_{Thr} = .001994X^2 + .1263X + 1.6842$  ( $R^2 = .5906$ ,  $P = .0281$ ) and  $\hat{Y}_{Val} = .001242X^2 + .1150X + 1.5167$  ( $R^2 = .6769$ ,  $P = .0109$ ), respectively. Daily lysine, threonine and valine requirements of lactating sows were 40.9, 31.7 and 46.3 g/d, respectively. The ratios of threonine/lysine and valine/lysine were .78 and 1.13, respectively. In conclusion, dietary limiting AA requirements of lactating sows can be determined by AA A-V differences across the mammary gland.

Key Words: Porcine Mammary Gland, Arterio-venous Difference, Amino Acid Requirement

15.49 Met  
30g Thr  
8.7 Trp

**622** Lysine requirement of the gestating sow determined by using plasma urea nitrogen as a rapid response criterion. J. C. Sparks\* and D. R. Zimmerman, *Iowa State University, Ames.*

Lysine requirements at two stages of gestation were estimated in adult sows who had been fed either a low (LL) or high lysine (HL) diet in the previous lactation period. Requirements were estimated using plasma urea nitrogen (PUN) as a rapid response criterion. Litters were standardized to 10 pigs, and sows were fed diets calculated to achieve intakes of 40 or 55 g/d of lysine (actual intakes of 35.4 and 50.1g/d). Five sows from each lactation treatment formed 5 x 5 Latin squares. Gestation treatments were intakes of 7.5, 9.62, 11.75, 13.88, and 16.0 g/d of lysine. Diets provided an ideal amino acid balance in the diet supplying 16.0 g/d of lysine. Diets had identical amounts of all nutrients except lysine, and were kept isonitrogenous by replacing lysine with glutamic acid. Sows received the treatment regimen twice in gestation; from 2 to 21 and again from 71 to 90 d postestrus; early gestation (EG) and late gestation (LG) respectively. PUN concentrations were averaged from samples collected via ear vein before the morning feeding on the third and fourth day of each the five 4-d treatment periods. There was a difference (P < .05) in weight loss during lactation between LL and HL sows; 21.2 and 4.0 kg, respectively. In addition, sows fed LL diet had more (P < .07) days of anestrus than sows fed HL diet; 5.6 and 4.7, respectively. There were, however, no differences in litter weight gain of sows fed LL and HL diets; 47.6 and 48.9 kg respectively. In addition, 3 of 11 sows fed LL did not conceive while all 10 sows fed HL conceived (P < .09) on first service. PUN concentrations decreased quadratically (P < .01) during both EG and LG with increasing dietary lysine intake in sows fed LL. PUN concentrations in sows fed HL did not respond as expected in EG, but in LG their PUN concentrations decreased linear (P < .01). A two slope broken line analysis indicated daily lysine requirements of 9.6 ± 1.5 and 12.2 ± 1.7 g/d in EG and LG, respectively for sows previously fed LL diets.

Key Words: Sows, Gestation, Lysine

**623** Lysine requirement for maximal lactation performance and subsequent litter size of primiparous lactating sows. H. Yang\*<sup>1</sup>, J. E. Pettigrew<sup>2</sup>, L. J. Johnston<sup>1</sup>, G. C. Shurson<sup>1</sup>, and R. D. Walker<sup>1</sup>. <sup>1</sup>University of Minnesota, St. Paul <sup>2</sup>Pettigrew Consulting International, Louisiana, MO.

First parity lactating sows (n = 208; PIC C-22) were used to evaluate the effects of lysine intake on lactation and subsequent reproductive performance. Sows (165 kg BW; 16 mm backfat) were assigned randomly to one of five diets (A, B, C, D, E) containing .60, .85, 1.10, 1.35 and 1.60% lysine, from intact protein sources. Diets were formulated to contain minimum ratios to lysine for valine (1.05), threonine (.75), sulfur amino acids (.63), using synthetic amino acids. All diets contained corn, SBM, 5% corn gluten meal, 5% soybean oil, 2.1 Mcal NE/kg and exceeded NRC (1988) requirements for other nutrients. Diets were made isoenergetic by including 0 to 8% rice hulls. Each sow nursed 10 pigs and was provided ad libitum access to feed during the 18-d lactation. Lysine intake had a quadratic effect on litter ADG (1859, 2062, 2001, 2016 and 1968 g for diets A, B, C, D, E, respectively; P < .05) and sow BW change (-1.4, -.1, -.1, 2.6, -2.5 kg for diets A, B, C, D, E, respectively; P < .05). Litter ADG did not increase when dietary lysine increased above .85%. Increasing dietary lysine resulted in a linear reduction in ADFI of sows and born alive of subsequent litters (5.36, 5.07, 4.79, 4.78, 4.52 kg and 10.97, 10.95, 10.61, 9.46, 8.87 pigs for diets A, B, C, D, E, respectively; P < .01). Lysine intake tended to affect sow backfat change and total born of subsequent litters (-.61, -1.23, -1.61, -.83, -1.77 mm and 11.67, 11.85, 11.37, 10.96, 10.14 pigs for diets A, B, C, D, E, respectively; P < .10), but had no effect (P > .1) on weaning-to-estrus interval (6.6, 5.7, 5.3, 5.8, 5.6 d), percent of sows mated by d 10 postweaning (70.7, 80.5, 81.0, 81.0, 78.6%) and subsequent farrowing rate (74.3, 75.7, 75.0, 75.7, 72.2%) for diets A, B, C, D, E, respectively. These results suggest that lysine requirement for subsequent reproduction is not higher than that for milk production, and the lysine requirement was 43 g/d for first parity lactating sows in this study.

Key Words: Lysine, Primiparous Sows, Litter Size

Total AA  
38.04  
15.5  
40.75 Lys  
16.09 Met  
32.11 Thr  
9.41 Trp  
32.2 total sulfur  
80%