

was used to determine rate of passage. Both fat level and source affected ($P < 0.05$) the apparent ileal digestibilities of some amino acids. Most apparent ileal amino acid digestibilities were numerically higher in diets supplemented with soybean oil than with palm oil. The LEU digestibility was improved ($P < 0.05$) from 81.0 to 84.8% with 20% soybean oil. Additionally, with increasing levels of soybean oil, SER, HIS, ARG, TYR and LEU digestibilities were linearly improved ($P < 0.05$). With increasing levels of palm oil, SER, HIS, ARG and PHE digestibilities were linearly improved ($P < 0.05$), while ILE and LEU digestibilities exhibited quadratic relationships ($P < 0.05$). Rate of passage was unaffected ($P > 0.05$) by either level or source of fat. In conclusion fat level and source affected apparent ileal amino acid digestibilities, but did not affect rate of passage.

Key Words: Pigs, Amino acid digestibility, Dietary fat

154 Effect of dietary glutamine and asparagine on growth performance and nitrogen retention of broiler chicks fed low-CP diets. K. Bregendahl* and D.R. Zimmerman, *Iowa State University, Ames.*

Low-CP diets result in inferior growth performance and(or) carcass quality in both pigs and broiler chicks even though the dietary AA levels meet established requirements. Glutamine (Gln) and asparagine (Asn), which have been shown to be conditionally essential and to improve feed utilization in weaning pigs, are inherently low in low-CP diets. An experiment was, therefore, conducted to investigate whether dietary additions of Gln and Asn influence growth performance and nitrogen (N) retention of broiler chicks fed low-CP diets. A total of 240 day-old broiler chicks was fed a common cornsoy diet (23% CP) for 1 wk after which the chicks were allotted to one of four diets in a completely randomized design (10 chicks per pen, 6 replications). Chicks had free access to feed and water in floor pens. All diets were isoenergetic and formulated on a true ileal-digestible AA basis to meet or exceed all NRC requirements. Treatment diets consisted of a cornsoy diet (control, D1, 23.4% CP) and a low-CP diet (D2, 19.2% CP) with 1% triammonium citrate (TAC) included. D3 (19.3% CP) and D4 (18.9% CP) were formulated as D2 with Gln and Asn, respectively, replacing TAC. Feed disappearance and BW were measured weekly and feed utilization (G:F) calculated. After 2 wk on test, chicks were fasted for 24 hours and two chicks per pen were euthanized and the whole-body N content determined. Data were analyzed using GLM and least-squares treatment means were separated using Fishers protected LSD. No differences in growth performance ($P > 0.21$) or N retention ($P > 0.80$) were observed among chicks fed the low-CP diets (D2, D3, and D4). Contrasts (low-CP diets vs D1) were, therefore, used to separate the effects of dietary CP level. Chicks fed the low-CP diets had inferior ($P < 0.05$) ADG (44.6 vs 46.8 g/d), ADFI (65.2 vs 63.2 g/d), G:F (0.68 vs 0.74), and N retention (1.16 vs 1.23 g/d) compared to chicks fed the high-CP diet. Thus, the inferior performance of chicks fed low-CP diets was probably not caused by a deficiency of Gln or Asn.

Key Words: Low crude protein, Glutamine, Asparagine

155 Dietary energy during prepubertal growth and reproductive development of gilts. J. Klindt*, J. T. Yen, and R. K. Christenson, *USDA ARS U.S. Meat Animal Research Center, Clay Center, NE.*

The objective was to determine degree of feed restriction during development required to optimize reproductive performance and efficiency in gilts. Different patterns of growth and reproductive performance through d 30 of gestation were investigated. At 13 wk of age, 41 kg BW, 192 white crossbred gilts were penned individually and assigned to receive 7/8, 3/4, 5/8 or 1/2 of ad libitum energy intake. At 25 wk of age, gilts were moved to group pens, fed ad libitum, and an 11-wk estrous detection period initiated. Gilts were inseminated at first detected estrus (puberty). Gilts were slaughtered at 30 d of gestation. Feed restriction during development resulted in differences in BW and backfat thickness at start of the breeding period and differences in daily feed intake (ADFI) during breeding. The lightest, leanest group at the start of breeding consumed the most feed during breeding and had the fewest no. of days to puberty, followed by the heaviest, fattest group that consumed the least feed during breeding. Treatments did not differ in ovulation rate or live embryo numbers ($P > 0.39$). Significant relationships between quantity of GE consumed during development and many development and reproductive performance variables were evident, e.g.,

BW and fatness at start of breeding, puberty, pregnancy, and ovulation rate. Ad libitum intake during breeding negated many effects of feed restriction during the development period. In contemporary swine production, use of managed nutritional strategies that include periods of restriction, and periods of ad libitum access to feed, may allow improvements in efficiency of pork production.

Treatment	25 wk Breeding		Days to puberty	% pubertal	Lv	Lv
	BW, kg	ADFI, kg ^a			Embryo /gilt ^a	Embryo efficiency ^{ab}
1/2 Adlib	77.8	3.76	15.3	85.4	8.9	0.0407
5/8 Adlib	92.8	3.28	24.5	79.1	8.4	0.0298
3/4 Adlib	103.7	3.19	27.9	87.5	8.6	0.0273
7/8 Adlib	112.7	3.06	22.4	85.4	7.8	0.0230
Pooled SE	0.5	0.05	1.3	—	0.4	0.0014

^aAll gilts assigned ^bLive embryos per kg feed 13 wk to 30 d gestation

Key Words: Gilts, Puberty, Growth

156 Fetal and maternal responses to ad libitum feed intake during early gestation. R.E. Musser*, D.L. Davis, R.D. Goodband, M.D. Tokach, and J.L. Nelssen, *Kansas State University, Manhattan.*

The influence of maternal nutrition during early gestation on fetal growth and plasma metabolite concentrations was examined using 10 fourth parity sows (C 15 sows bred to line 326 boars; PIC). Sows were fed either 1.8 kg/d of a gestation diet (control, n=6) or ad libitum (7.0 kg/d; high, n=4) of feed from d 30 to 56 of gestation. At 3 h after feeding on d 56, sows were anesthetized and their reproductive tracts exposed by laparotomy. Starting from the tip of the right uterine horn, allantoic and amniotic fluid samples were collected followed by exposure of the fetal umbilical vein and harvest of fetal blood. Next, the fetus was removed, weighed, crown-rump length was measured, and a liver sample collected and frozen. Fluid and plasma samples were assayed for glycogen. Fetal pigs were homogenized and total protein, fat, ash, and moisture determined. Sows gained more weight when fed ad libitum (41.16 vs 2.12 kg; $P < .01$) compared to controls. Allowing sows to consume feed ad libitum resulted in an increased plasma IGF-I and plasma urea N concentrations in the sow and fetuses. No differences ($P > .05$) were found for plasma insulin or glucose in sows or fetuses. Allantoic and amniotic fluid urea N concentrations were influenced by treatment. In addition to increased fetal urea N concentration, sows fed ad libitum produced fetuses with heavier ($P < .05$) livers. These responses would suggest an increased rate of deamination of amino acids. Fetuses from sows fed ad libitum had decreased ($P < .03$) crown-rump length variation. Control sows exhibited a negative relationship ($R = .43$; $P < .05$) between the number of fetuses and average fetal weight (maternal limit). However, this relationship was not detected in ad libitum sows ($R = .14$; $P > .10$). Providing feed in excess of established requirements to gestating sows from d 29 to 45 increased IGF-I in maternal plasma, increased urea N in the sow and fetus, and weakened the maternal limit.

Key Words: Fetal, IGF-I, Sow

157 Determining the effect of increasing L-carnitine additions on sow performance and muscle fiber development of the offspring. R.E. Musser*¹, R.D. Goodband¹, K.Q. Owen², D.L. Davis¹, M.D. Tokach¹, S.S. Dritz¹, and J.L. Nelssen¹, ¹Kansas State University, Manhattan, ²Lonza, Inc..

During gestation, nutritional state of the sow can influence birth weight, muscle fiber number, and growth potential of the offspring. A total of 207 sows was used in two experiments to determine the effects of L-carnitine in the gestation diet on sow performance and offspring development. Sixty-six sows (PIC line 42 sows bred to 326 boars) were fed 1.8 kg/d of feed (0.60% total lysine, 0.9% Ca, and 0.8% P) with a topdress that provided a total of 0, 50, 100, or 200 ppm added L-carnitine. In Exp. 2, 141 sows (PIC C-22 sows bred to line 56 boars) were used. Sows were fed 1.8 kg/d of feed (0.65% total lysine, 0.83% Ca, and 0.76% P) and a topdress as in Exp. 1. The experiments were combined for analysis of production criteria, but muscle fiber data was analyzed separately due to differences in pig age at sampling. Cubic differences were observed ($P < .10$) in subsequent number of pigs born per litter (10.7, 11.5, 10.0, or 10.9) for sows fed 0, 50, 100, or 200 ppm of L-carnitine.