.10) between treatments. G/F did not differ between HS and LS diets (P > .10) except during Phase II when pigs fed HS had higher G/F than pigs fed LS (P < .10). Average ODU, H_2S, and NH_4 levels tended to increase weekly during the 5-wk feeding period. Feeding LS had no effect on ODU and H2S during wk 1 and 2, but tended to reduce ODU and H2S during wk 3, 4, and 5. Weekly and final NH_4 level was unaffected by dietary treatment. These results suggest that use of alternative reduced sulfur ingredients in starter diets may reduce odor and H_2S emissions in confinement nursery rooms without reducing pig performance.

Key Words: Sulfur, Odor, Hydrogen sulfide

189 Calculated body-N loss or infused alanine-N is not recovered from starved newborn pigs. N.J. Benevenga*, T.W. Rasch, L.G. Haas, B.D. Mickelson, and J.A. Davis, *University of Wisconsin-Madison, Madison, WI.*

Estimating body nitrogen (N) loss by comparative slaughter in newborn pigs starved for 60 h (12-72 h of age) and comparing it to N measured in urine revealed that 30-50% of body-N loss was recovered in urine (FASEB J. 9:A745 1995). In other studies, 4 small pigs (.99±.16 kg) and 4 large pigs (1.86±.16 kg) were given alanine IV with levels stepped every 6 h from 0 to 25, 50 and 75% of fasting heat production followed by infusion of water for 12 h. The recovery of the infused alanine-N in both urinary-N and the expanded body urea-N pool was 73% and 54% in small and large pigs respectively (FASEB J. 10:A472 1996). In these studies, expired ammonia accounted for between .1 and 1.0% of the infused alanine-N. Urinary nitrate-N in piglets starved for 60 h could account for .6% of body-N loss. Because the standard Kjeldahl used to measure total N in the previous studies does not detect oxidized N (nitrite and nitrate), it was modified to include these N compounds. When comparing the two Kjeldahl methods, no methods difference (P≥.05) in body-N or urinary-N in 7 pigs was detected. A closed circuit respiration system was developed so possible gaseous forms of N loss from ^{15}N L-alanine, particularly $^{28}N_2$, $^{29}N_2$ and $^{30}N_2$, could be sampled, identified and measured. Nine pigs were infused IV with either ^{15}N enriched L-alanine (2.5 A.P.) or unenriched alanine (.37 A.P.) for 60 h. After establishing and maintaining an atmosphere of 80% Ar and 20% O_2, no change (P≥.05) in N-containing gases was seen. Studies were carried out with 4 newborn pigs to determine if ^{15}N from L-alanine could be quantitatively recovered in the body, urine or N-gas, by infusing them IV with ^{15}N enriched L-alanine (2.5 A.P.) for 60 h followed by a 12 h water infusion. The average total recovery (mean±S.D.) of the infused ^{15}N was 75.1±3.5% with 41.6±2.8% in the body, 33.5±1.7% in urine and none in N-gas. If N cannot be accounted for, the conclusion from these three approaches cast doubt on the use of N-balance to estimate requirements.

Key Words: Newborn Pig, Body-N, N-loss

190 Effects of corn hybrids fed to growing pigs on nitrogen metabolism. J. L. Snow*[1], L. L. Andersen[2], D. Rozeboom[2], M. Allen[2], and N. L. Trottier[2], [1]*University of Illinois; Urbana, IL,* [2]*Michigan State University; East Lansing, MI.*

Eight barrows (19.11 ± .49 kg, Yorkshire) were arranged in two 4 x 4 Latin squares to investigate the effect of feeding different corn hybrids on nitrogen balance. The test corns were: high oil (HO), isogenic high oil (IHO), waxy (WX), isogenic waxy (IWX), high lysine (HL), yellow dent one (YD1), yellow dent two (YD2). Pigs were fed corn-based diets consisting of 96.87 % test corn. Pigs were allowed adjustment period to diets (5d) followed by five days of total urine and fecal collection. Nitrogen (N) retained was not different between HO vs IHO, WX vs IWX and HL vs YD1 ($P \geq .1$; see table). Nitrogen retention as a percent of N intake and N absorbed was similar between HO vs YD2 and WX vs YD2 ($P \geq .1$), but was different when HL was compared to YD2 ($P \leq .05$). Overall, pigs fed the YD1, HL and HO corns retained numerically more nitrogen consumed and absorbed than all other corns.

Item	HO	IHO	WX	IWX	HL	YD1	YD2
n	4	4	4	4	4	4	7
N retained, g/d	7.92^{af}	6.78^{a}	6.62^{ad}	5.97^{a}	10.05^{af}	11.34^{a}	$4.9\ 9^{d}$
N digestibility, %	83.31^{af}	78.90^{a}	74.04^{ad}	77.80^{b}	81.06^{af}	83.30^{a}	74.12^{d}
N retention, % of intake	49.74^{ad}	45.58^{a}	44.55^{ad}	42.03^{a}	57.22^{af}	62.36^{a}	38.48^{d}
N retention, % of absorbed	59.73^{ad}	57.73^{a}	59.14^{ad}	53.39^{a}	70.75^{af}	75.06^{a}	52.34^{d}

^{a,b} Means in rows with different superscripts are different among these comparisons: HO vs IHO, WX vs IWX, HL vs YD1 ($P \leq .1$) ^{a,c} Means in rows with different superscripts are different among these comparisons: HO vs IHO, WX vs IWX, HL vs YD1 ($P \leq .05$) ^{d,e} Means in rows with different superscripts are different among these comparisons: HO vs YD2, WX vs YD2, HL vs YD2 ($P \leq .1$) ^{d,f} Means in rows with different superscripts are different among these comparisons: HO vs YD2, WX vs YD2, HL vs YD2 ($P \leq .05$)

Key Words: Nitrogen retention, specialty corns, pigs

191 Effect of dietary soy genistein on growth and immune response in pigs during a viral challenge. L.L. Greiner*[1], T.S. Stahly[1], and T.J. Stabel[2], [1]*Iowa State Univeristy, Ames, IA,* [2]*USDA/ARS/National Animal Disease Center, Ames, IA.*

Twelve replications of four littermate pigs from a PRRS negative herd were weaned (10 ± 2 d) and penned individually in isolation chambers. Pigs were randomly allotted within litter to one of four dietary soy genistein concentrations (0, 200, 400, 800 ppm) to quantify the effect of genistein on growth and immune response during a PRRS challenge. Genistein was provided as the soy glycoside, genistin. At 21 ± 2 d of age (4.9 ± 1.4 kg BW), pigs were oral-nasally inoculated with 2 mL of 10^4 PRRS virus strain JA142/mL. Blood was collected every 4 d from d 0 to 24 post-inoculation (PI) and analyzed for serum PPRS virus, gamma-interferon (γ-IFN), and alpha-1-acid glycoprotein (AGP) concentrations. Serum virus and γ-IFN peaked at $10^{5.25}$ virus/mL and 96% protection, respectively, at 4 d PI and then declined steadily. Serum AGP concentration peaked at 12 d PI. Each 10-fold increase in serum virus was associated with a reduction of daily gain of .013 kg in pigs 4 to 8 d PI and .025 kg in pigs 16 to 20 d PI. Serum virus concentration decreased (P<.07) linearly as dietary genistein concentrations increased ($10^{2.46}$, $10^{2.26}$, $10^{2.05}$, $10^{2.14}$ virus per mL of serum) independent of days PI. Serum concentrations of γ-IFN responded quadratically (P<.06) as dietary genistein concentrations increased (28.4, 25.7, 22.8, 30.9% protection). AGP concentrations also increased (P<.01) quadratically; however, the magnitude of the response decreased over time. Increased dietary genistein concentrations resulted in a cubic response (P<.13) in daily pig gain (.246, .287, .252, .228 kg) and a quadratic response (P<.03) in daily feed intake (.317, .360, .349, .289 kg) independent of days PI. These data indicate that the magnitude of the biological responses that occur in pigs infected with PRRS are directly related to the animal's serum virus concentration, and that low concentrations of dietary soy genistein reduce virus concentration and improve body growth in virus challenged pigs.

Key Words: Genistein, Growth, Immune Response

192 Enteric disease challenge effects on pig growth, N balance, and immune indicators. J.A. Loughmiller*, S.S. Dritz, M.D. Tokach, R.D. Goodband, J.L. Nelssen, M. De La Llata, and S.A. Moser, *Kansas State University, Manhattan.*

Pigs (30 ± 1 kg) were used in a 25 d trial to determine the effects of an enteric disease challenge on N balance, growth performance, and immune variables. Pigs (n=21) were challenged on d 8 with Salmonella typhimurium (S), unchallenged and fed ad libitum (A; n=6), or unchallenged and pair-fed the feed intake of a challenged pig (P; n=8). Collection periods were d 4 to 7, 8 to 11, 12 to 15, 16 to 19, and 22 to 25. Blood was collected on d 5, 9, 13, 17, and 23. There was a disease

challenge × time interaction (P < .05) for ADG, due to decreased ADG (P < .01) for S vs A from d 8 to 11 (617 vs 1385 g). Pair-fed pigs had intermediate ADG (949 g), and differed from S (P < .07). Gain/feed was lower for S vs P from d 8 to 11 (.20 vs .62; P < .05). There was a disease challenge × time interaction for retained N (P < .05), indicating reduced lean growth from d 8 to 11 for S (19.6 g/d; P < .01) and P (23.2 g/d; P < .07) vs A (30.1 g/d). From d 8 to 11, N retention, as a percentage of N intake or N absorbed, was worse for S (38.6%, 34.4%) vs A (57.0%, 65.5%; P < .05), and P (51.7%, 58.7%; P < .07). While short-term differences were evident, d 8 to 25 growth performance and N balance were not affected (P > .20), except for increased DM digestibility and decreased fecal N for S vs A (P < .05). There was a disease challenge × time interaction for serum haptoglobin (P < .05), with higher haptoglobin on d 9 and 13 for S vs A, (P < .05) and S vs P on d 13 (P < .05) and 17 (P < .10). On d 13 and 17, serum alpha-1 acid glycoprotein was only higher for S vs A (P < .05). Plasma IGF-I increased from d 4 to 25 (linear, P < .05), and was higher for S vs A on d 17 (P < .10), d 23 (P < .05), and for S vs P (P < .05) on d 17. Results indicate that short-term reductions in N balance and growth performance from an acute disease challenge are due to feed intake reductions and immune response nutrient repartitioning. Because of compensatory gain during recovery, long-term effects were minimal.

Key Words: Pig, Salmonella, N Balance

PHYSIOLOGY

193 The effect of exogenous estradiol-17β ($E_2\beta$) during elongation on placental size at d112 of gestation in the Meishan (M) pig.

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Day 2.5 transferred M embryos are larger, contain more trophectoderm cells and secrete more $E_2\beta$ when gestated in a Yorkshire (Y) as compared to M uterus to d12. Additionally, placentae of M conceptuses are larger when gestated in a Y uterus as compared to a M uterus to d112. Embryonic $E_2\beta$ secretion during elongation on d12-13 is thought to stimulate endometrial secretion of growth factors including IGF-I. This experiment was conducted to determine if exogenous $E_2\beta$ given to straight-bred M females during conceptus elongation would increase placental size of M conceptuses. M females (n=12) were checked twice daily for estrus (0700 and 1900) and bred to a M boar at 0 and 12h after the onset of estrus (d0). Bred females were randomly assigned in equal numbers to receive eight 1 ml injections (im) at 6h intervals starting at 0700 or 1900 (time of day when first in estrus), of sesame oil starting on d12 (Veh), 1mg of $E_2\beta$ in sesame oil starting on d12 (E12), or 1mg of $E_2\beta$ in sesame oil starting on d13 (E13). Pregnant females were then slaughtered on d112 of gestation and ovulation rate, litter size, fetal weight (FW), crown-rump length (CRL), placental weight (PW) and placental surface area were quantified. As there were no differences in any of the measurements between E12 and E13, the $E_2\beta$ groups were combined (E) for analysis. There were no differences between E and Veh treated females in ovulation rate or litter size, which averaged 16.3±.7 and 11.8±.7. FW and CRL were not different (P¿.10) between E and Veh treated females, averaging 802±26 g and 24.3±.3 cm. Placentae were heavier (P<.05) and larger (P<.001) in E treated females than in Veh treated females (175±10 g and 1428±65 cm^2 vs 134±10 g and 978±29 cm^2, respectively). In addition, placental efficiency (as estimated by the FW:PW) was greater (P<.05) in the Veh as compared to E treated females (5.8±.2 vs 4.9±.2). These data demonstrate that the amount of embryonic $E_2\beta$ produced around the time of elongation effects placental size at term.

Key Words: Pig, Placental size, Meishan

194 Estrogen receptor genotype is not associated with placental size in the pig.

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Litter size is positively associated with placental efficiency (PE), defined as a piglet's birth weight to that of its placenta (Wilson, et al., 1998; Proc Midwest Sec ASAS; abstract #170). By selecting progeny with a greater PE, we increased litter size in a single generation in Yorkshire pigs. Although we have evolved an efficient way to match each piglet with its placenta, much time is invested in obtaining these measurements. Allelic polymorphism (A and B) associated with the estrogen receptor gene has been proposed by others (Rothschild et al., 1996; PNAS 93 201-205) as a marker for litter size. It was our objective to determine if there was any association between the estrogen receptor genotype of an individual piglet and its observed PE. The current study analyzed 249 Yorkshire piglets from 32 litters representing animals selected on PE (high and low) as well as unselected controls. Sows were monitored at farrowing, with each piglet's umbilical cord double tagged and cut to allow piglets to be matched with their placentae. Ear tissue was obtained and estrogen receptor genotyping was performed by PCR as described by Short et al. (1997; JAS 75 3138-3142). We confirmed previous data that PE shows significant variation both among (range 2.15 to 8.87) and within (range 2.96 to 8.59) litters. Although there was a positive correlation (r=.58, p<.0001) of piglet birth weight with placental weight, there was no correlation of piglet birth weight with PE. There was however, a strong negative correlation (r=-.62, p<.0001) between placental weight and PE. There was no effect of piglet estrogen receptor genotype on placental weight or PE (p>.50). Further, there was no obvious skew in the genotypes (AA, AB or BB) of animals that were selected on PE compared to unselected controls. Therefore, estrogen receptor genotype gives no insight into a piglet's PE, a trait known to be associated with litter size in the Yorkshire breed.

Key Words: Estrogen receptor gene, Litter size, Placental efficiency

195 Inability of Progesterone to Delay Return to Estrus in 14 d Weaned Sows.

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Segregated early weaning has been instituted to improve growth, efficiency, and health status of weaned pigs. Sow reproductive performance is impaired when sows are weaned at 14 d or less. Greatest limitations are seen in reduced conception rates and subsequent litter size, and an increase in length and variation of wean-to-estrus interval (WEI). The immediate objectives of the present experiment were to determine the effect of a single injection of progesterone (P_4) on the WEI, return of LH pulsatility, and consistency of return to estrus in early-weaned sows. A total of 38 sows were weaned at 9 to 14 d of lactation. Nineteen sows were injected at weaning with 4,000 mg of P_4 dissolved in 8 ml of sesame seed oil and the other 19 sows served as controls and were given an 8-ml sesame seed oil injection. Twenty-three sows were fitted with indwelling jugular catheters and blood collected every 4 hours for 6 d beginning 8 hours after weaning to determine P_4 concentration. Blood samples were also collected at 20-minute intervals for 6 hours beginning the day after weaning for 8 d for LH assays. Sows were checked twice daily for return to estrus with a mature boar starting on day 3 post-weaning. WEI ranged from 3 to 14 d with no significant difference (P>0.05) between treatments. Two sows remained anestrus and were not included in the WEI analysis. The P_4 treated sows had a significantly higher (p<0.01) levels of P_4 (.40 vs 4.77 ng/ml) lasting for approximately 30 hours after weaning. The LH data were analyzed for mean LH, the number of peaks in a 6-hour period, average peak amplitude, and average baseline LH. There were no significant interactions between treatment and time for any of the above parameters. In summary, the single P_4 injection cleared the system too quickly to delay return to estrus. Although P_4 concentrations were elevated in the treated group, no significant change was observed in the LH pulsatility or consistency of return to estrus. Future research is needed to determine the possibility of another delivery mechanism.

Key Words: early wean, wean-estrus-interval, sow

196 Follicular development and atresia during the luteal phase of the estrous cycle in gilts selected for high ovulation rate and controls.

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Follicular development and atresia were characterized during the luteal phase in two genetic lines differing in ovulation rate (RLS, n=62, cross of Relax Select and Litter Size and C, n=45,randomly selected control line). Gilts were assigned randomly within sire for ovary recovery on days 5, 8, 11 and 14 (d 0 = first d of estrus)of the estrous cycle. Ovaries