0.006). In conclusion, the present findings suggest that increased nutrient intake during the suckling period altered muscular metabolic status and improved skeletal muscle growth possibly via regulation of insulin-like growth factor 1/Ak thymoma/mammalian target of rapamycin signaling pathway.

Key Words: intra-uterine growth-retarded pigs, nutrient intake, skeletal muscle

1951 (W381) The inclusion of yeast-derived protein in weanling diet improves growth performance, anti-oxidative capability and intestinal health of piglets. L. Hu, L. Che*, G. Su, Y. Xuan, G. Luo, F. Han, Z. Fang, Y. Lin, S. Xu and D. Wu, *Institute of Animal Nutrition, Sichuan Agricultural University, Chengdu, China*

This study aimed to investigate the effects of yeast-derived protein (YP) on growth performance, intestinal health and oxidative status of weaned piglets. A total of 80 weaned piglets (PIC 327 × 1050, 26 ± 2 d-old) were randomly allocated into 2 groups, 5 pens each group and 8 piglets each pen, receiving control diet and diet with inclusion of 4% YP at the expense of fish meal (YP diet) for a period of 28 d. Piglets had free access to pelleted feed and water. Feed intake was recorded daily and piglets were weighed weekly for calculating ADG, ADFI and G:F. At d 28, blood samples were collected from the cervical vein and centrifuged (3000 ×g, 4°C, 15 min) to separate serum for biochemical assays. Then these piglets were anaesthetized with intravenous injection of pentobarbital sodium (15 mg/kg body weight) and slaughtered. Approximately 2 cm of ileal tissue was collected each piglet and stored at −80°C for real-time RT-PCR. Moreover, the chyme of ileum and colon were removed and stored at −80°C for microbial analysis. Data were analyzed using one-way analysis of variance (ANOVA) procedure of SPSS 20.0 (Chicago, IL, USA) and are reported as means ± SEM. The results showed that piglets fed YP diet had markedly higher overall ADG (470 ± 18 vs. 412 ± 12 g, P = 0.034) and G:F (0.72 ± 0.02 vs. 0.67 ± 0.01, P = 0.001). Serum concentration of urea was significantly decreased (166.58 ± 9.57 vs. 306.34 ± 26.89 mmol/L, P = 0.003) in piglets fed YP diet relative to piglets fed control diet. Moreover, serum activity of glutathione peroxidase (GP_X) was markedly increased (303.31 ± 7.22 vs. 255.54 ± 8.53 umol/L, P = 0.003) in piglets fed YP diet relative to piglets fed control diet. In addition, feeding YP diet significantly increased the DNA copy numbers (log^{10} Cfu/g of digesta) of lactobacilli (8.27 ± 0.13 vs. 7.20 ± 0.17, P = 0.021) and total bacteria (10.44 ± 0.06 vs. 10.26 ± 0.04, P = 0.044) in the colonic digesta of piglets. Furthermore, mRNA expression of the innate immunity-related genes (TLR4, NF-κB1 and IL-6) tended to increase (1.33 ± 0.11 vs. 1.00 ± 0.07, P = 0.057; 1.92 ± 0.15 vs. 1.00 ± 0.21, P = 0.024; 1.45 ± 0.10 vs. 1.00 ± 0.15, P = 0.041, respectively) in the ileum of piglets fed YP diet relative to piglets fed control diet. In conclusion, the diet with inclusion of YP improved growth performance, anti-oxidative capability and intestinal health of weaned piglets.

Key Words: growth, piglet, yeast

1952 (W382) Effects of added zinc during the grower and/or finisher phase on growth performance and carcass characteristics of finishing pigs fed diets with or without ractopamine HCl. C. B. Paulk*, M. D. Tokach, S. S. Dritz, J. M. DeRouchey and R. D. Goodband, *Kansas State University, Manhattan*

A total of 1197 pigs (PIC 337 × 1050) were used in a 72-d study to determine the effects of added Zn from ZnO fed during the grower (d 0–45; initially 58.8 kg) and finisher (d 45–72; initially 99.0 kg) in diets with or without racto-

Table 1952. Effects of added zinc during the grower and/or finisher phase on growth performance and carcass characteristics of finishing pigs fed diets with or without ractopamine HCl

Added Zn d 0–45:	-	-	-	-	+	+	+	+	
Added Zn d 45–72:	-	+	-	+	-	+	-	+	
Added RAC d 45–72:	-	-	+	+	-	-	+	+	SEM
d 0 to 72									
ADG, kg	0.89	0.88	0.95	0.95	0.89	0.88	0.97	0.96	0.01
ADFI, kg	2.65	2.60	2.60	2.63	2.69	2.68	2.71	2.72	0.05
G:F	0.34	0.34	0.37	0.36	0.33	0.33	0.36	0.35	0.00
Final BW, kg	118.7	118.0	122.9	123.6	119.4	118.0	124.0	124.2	2.7
Carcass Characteristics									
HCW, kg	86.0	86.0	88.2	90.0	85.4	87.1	88.7	89.5	2.2
Yield,[1%]	74.09	74.12	74.64	75.35	73.09	75.52	73.98	74.08	1.35
Backfat thickness,[2] mm	16.75	15.69	13.81	14.86	16.29	16.28	14.13	13.67	0.63
Loin depth,[2] mm	62.64	61.71	64.59	63.12	61.99	61.58	65.52	66.06	1.13
FFLI,[2%]	53.13	53.70	55.13	55.13	53.52	53.33	55.01	55.94	0.57

[1] Calculated by dividing HCW by live weight obtained at the packing plant.
[2] Adjusted using HCW as a covariate.

pamine HCl (RAC; Elanco Animal Health, Greenfield, IN) on growth performance and carcass characteristics. There were 25 pigs per pen and 6 pens per treatment. Pens were randomly assigned to a 2 × 2×2 factorial arrangement in a split-plot design. The whole plot consisted of diets with or without 75 ppm added Zn from d 0 to 45 and the subplots were diets with or without 75 ppm added Zn and with or without 10 ppm RAC from d 45 to72. All diets contained 50 ppm Zn supplied from the premix. No interactions were observed. Addition of 75 ppm Zn during either period or both did not influence pig growth performance or carcass characteristics. Pigs fed RAC had improved ($P < 0.03$) ADG, G:F, final BW, HCW, loin depth, and fat-free lean index compared with pigs fed the control diet. In conclusion, feeding RAC improved the performance of grow-finish pigs; however, additional Zn did not.

Key Words: growing-finishing pigs, ractopamine HCl, zinc

1953 (W383) Postnatal nutrition restriction affects growth and immune response of intrauterine growth restricted piglets. L. Hu, L. Che*, Y. Liu, Y. Xuan, F. Han, Z. Fang, Y. Lin, S. Xu and D. Wu, *Institute of Animal Nutrition, Sichuan Agricultural University, Chengdu, China*

Epidemiological studies and experimental models show that intrauterine growth restriction (IUGR) followed by accelerated postnatal growth is associated with increased susceptibility to diseases in later life. We hypothesized that postnatal nutrition restriction may improve intestinal development and immunity of IUGR neonates. Piglets with a birth weight near the mean litter birth weight (SD 0.5) were identified as NBW, whereas those with at least 1.5 SD lower birth weight were defined as IUGR. Twelve pairs of normal-birth weight (NBW) and IUGR piglets at 7 d of age were randomly assigned to adequate (ANI) or restricted nutrition intake (RNI) for a period of 21 d, which produced 4 experimental groups (birth weight/nutrition intake) as NBW-ANI, IUGR-ANI, NBW-RNI and IUGR-RNI ($n = 6$ per group). The NBW-ANI and IUGR-ANI piglets had free access to formula milk, while the NBW-RNI piglets had same intake of formula milk as IUGR-ANI piglets. To achieve the same degree of nutrition restriction as NBW piglets, the formula milk intake of IUGR-RNI piglets was based on the calculation that the formula milk intake of IUGR-ANI piglets multiplied by the formula milk intake of NBW-RNI piglets and divided by the formula intake of NBW-ANI piglets. At d 28, blood and intestinal samples were collected at necropsy and analyzed for cellular immune response and expression of innate immunity and DNA methylation-related genes. Data were analyzed by SPSS software using the MIXED procedure. The results indicated that both IUGR and postnatal nutrition restriction decreased (-26%, $P = 0.002$) ADG during the experimental period, but there was comparable ADG between IUGR-ANI and NBW-RNI piglets. The relative weight of intestine, heart or brain to body weight was higher (+9%, $P = 0.091$; +23%, $P = 0.025$ and +41%, $P = 0.001$; respectively) in IUGR than that in NBW piglets. Irrespective of body weight, number of peripheral leucocytes, lymphocytes and monocytes were significantly decreased (-25%, $P = 0.006$; -37%, $P = 0.001$ and −82%, $P = 0.009$; respectively) by RNI, whereas the ratio of $CD4^+$ to $CD8^+$ in blood was significantly increased (+27%, $P = 0.034$) by RNI, however, it did not markedly differ between NBW-ANI and IUGR-RNI piglets. Likewise, ileal mRNA expression of innate immunity and DNA methylation-related genes (*TLR-9* and *DNMT1*) were up-regulated in piglets with RNI (+31%, $P = 0.004$ and +57%, $P = 0.001$; respectively), particularly increased in IUGR-RNI relative to IUGR-ANI piglets. In conclusion, the present study indicated that postnatal nutrition restriction may affect systematic and intestinal immune response of IUGR piglets.

Key Words: pigs, intestine, innate immunity

1954 (W384) Effects of dietary omega-3 polyunsaturated fatty acids on growth and immune response of weanling pigs. Q. Li, J. H. Brendemuhl, K. Jeong and L. Badinga*, *University of Florida, Gainesville*

The recognition that *omega*-3 polyunsaturated fatty acids (*n*-3 PUFA) possess potent anti-inflammatory properties in human models has prompted studies investigating their efficacy for animal growth and immunity. The objective of this study was to examine the effect of feeding an *n*-3 PUFA-enriched diet on growth and immune response of weanling piglets. Newly weaned pigs (averaging 27 ± 2 d of age and 8.1 ± 0.7 kg of BW) were assigned randomly to receive a control (3% vegetable oil, $n = 20$) or *n*-3 PUFA-supplemented (Omega, $n = 20$) diet for 28 d after weaning. Diets were formulated to be isocaloric (3.3 Mcal/kg of diet) and isolysinic (14 g Lys/kg of diet). A diet × gender × week interaction was detected ($P < 0.04$) for body weight. Female pigs consuming the *n*-3 PUFA-enriched diet were lighter ($P < 0.01$) at wk 4 post-weaning than their counterparts fed the vegetable oil-supplemented diet. Newly weaned pigs gained more weight ($P < 0.01$), consumed more feed ($P < 0.01$) and had better G: F ($P < 0.01$) between d 14 and 28 than between d 0 and 14 post-weaning. Peripheral IGF-1 concentration decreased ($P < 0.01$) between d 0 (87.2 ± 17.0 ng/mL) and 14 (68.3 ± 21.1 ng/mL) after weaning and then increased again by d 28 (155.2 ± 20.9 ng/mL) post-weaning. In piglets consuming the vegetable oil-enriched diet, plasma TNF- α concentration increased ($P < 0.04$) from 37.6 ± 14.5 to 102.9 ± 16.6 pg/mL between d 0 and 14 post-weaning and remained high through d 28 (99.0 ± 17.2 pg/mL) post-weaning. The TNF-α increase detected in the piglets fed vegetable oil was not observed in the piglets fed *n*-3 PUFA (d 0 = 33.0 ± 17.2