decrease of free lysine in serum (172.47 vs. 249.03 μ*M*; $P < 0.01$) and increase of acetic acid in cecal fluid (1.69 vs. 1.24 m*M*; $P < 0.01$). Overall, metabolomic analysis provided novel and comprehensive information on the metabolic events associated with HS and Zn supplementation, which warrant further investigation into the roles of these metabolic events in growth and stress response.

Key Words: heat stress, metabolomics, zinc supplementation

119 **A survey of added vitamin concentrations used in the U.S. swine industry.** J. R. Flohr*, M. D. Tokach, J. C. Woodworth, J. M. DeRouchey, R. D. Goodband, S. S. Dritz, *Kansas State University, Manhattan.*

Swine producers and nutritionists representing production systems in the United States were surveyed about added dietary vitamin concentrations in swine diets used from March to June of 2014. In total, 18 respondents participated representing approximately 2.3 million sows (~40% of the U.S. industry). Respondents were asked to provide vitamin premix concentrations, inclusion rates, and weight ranges associated with feeding phases. Data were compiled into weight ranges that were relatively consistent across participants. There were 3 nursery phases (Phase 1, 5 to 7 kg; Phase 2, 7 to 11 kg; and Phase 3, 11 to 25 kg), 4 finishing phases (early, 25 to 50 kg; mid, 50 to 100 kg; late, 100 to 135 kg; and late with ractopamine, 100 to 135 kg), and 4 breeding herd dietary phases (gilt development, gestation, lactation, and boar). In Phase 1 nursery diets, supplementation rates were 4.8, 11.6, 4.6, 7.7, 2.3, 1.6, 2.5, and 2.0 times the 2012 NRC requirement for A, D, E, K, riboflavin, niacin, pantothenic acid, and vitamin B_{12} (cobalamin), respectively. Vitamin D supplementation rates were the most variable among participants with a standard deviation of 2,306 IU/kg. Meanwhile, for late finishing pigs, supplementation rates were 3.2, 5.0, 1.8, 3.6, 1.8, 0.7, 1.8, and 3.3 times the NRC requirement for A, D, E, K, riboflavin, niacin, pantothenic acid, and vitamin B_{12}, respectively. The average niacin supplementation was below the NRC requirement, likely due to the recent increase in requirement from the 1998 to 2012 publication. Supplementation rates in lactation diets were 5.2, 2.2, 1.6, 7.3, 2.2, 4.6, 2.3, and 2.4 times the NRC requirement for A, D, E, K, riboflavin, niacin, pantothenic acid, and vitamin B_{12}, respectively. Lactation diets also contained on average added thiamin, 2.2 mg/kg (5 respondents); pyridoxine, 3.5 mg/kg (13 respondents); biotin, 0.29 mg/kg; and folacin 1.68 mg/kg. Understanding current supplementation practices may help develop experimental designs to test future alternative vitamin supplementation practices.

Key Words: survey, swine industry, vitamins

Table 119.

Vitamins	Nursery Phase 1		Late finishing		Lactation	
	Mean	SD	Mean	SD	Mean	SD
A, IU/kg	10,622	833	4,194	1,001	10,425	922
D, IU/kg	2,561	2,306	747.0	209.4	1,793	349.4
E, IU/kg	74.1	27.8	20.1	6.6	70.3	70.3
K, mg/kg	3.9	0.4	1.8	0.4	3.8	1.1
Riboflavin, mg/kg	9.1	1.1	3.6	0.9	8.2	1.3
Niacin, mg/kg	49.1	11.5	20.2	4.9	45.9	11.7
Pantothenic acid, mg/kg	30.2	3.7	12.6	3.1	27.6	3.7
Vitamin B_{12}, μg/kg	39.1	2.4	16.6	3.5	35.5	4.6

NONRUMINANT NUTRITION: EXOGENOUS ENZYMES

120 **Effects of phytase on phosphorus digestibility of rice co-products fed to growing pigs.** G. A. Casas*, H. H. Stein, *University of Illinois at Urbana-Champaign, Urbana.*

The objectives of this experiment were to determine the apparent total tract digestibility (ATTD) and the standardized total tract digestibility (STTD) of P, and the effect of microbial phytase on ATTD and STTD of P in full fat rice bran (FFRB), defatted rice bran (DFRB), brown rice, broken rice, and rice mill feed when fed to pigs. Ninety-six barrows (initial BW 19.4 ± 1.4 kg) were allotted to 12 diets, with 8 replicate pigs per diet in a randomized complete block design. A basal diet based on corn and soybean meal was formulated, and 5 diets were formulated by adding each of the 5 rice co-products to the basal diet. Six additional diets that were similar to the initial 6 diets, with the exception that 500 units of microbial phytase (Optiphos; Enzyvia, Sheridan, IN) were included were also formulate. The ATTD of P was calculated for each diet using the direct procedure. The STTD of P was calculated for each diet by correcting the ATTD of P for the endogenous P losses. The ATTD and STTD of P in each rice co-product were calculated using the difference procedure. The concentration of P in feces was reduced ($P < 0.05$) from pigs fed diets containing microbial phytase compared with pigs fed diets without phytase. The total daily P output in feces from pigs fed diets with phytase was also less ($P < 0.05$) than in feces from pigs fed diets without microbial phytase, except for diets containing broken rice. Among the rice co-products, the greatest ($P < 0.05$) ATTD and STTD of P were observed for broken rice regardless of inclusion of phytase. The ATTD of *P* was greater ($P < 0.05$) for all ingredients except DFRB if microbial phytase was used than if no microbial phytase was used, and the STTD of P in brown rice, FFRB, rice mill feed was also greater ($P < 0.05$) if microbial phytase was used than if no microbial phytase was used. In conclusion, the STTD of