

- 63 Effects of Dietary Calcium and Phosphorus Deficiency on Growth Performance and Subsequent Recovery of Bone Mineralization in Replacement Gilts.** Piterson Floradin¹, Candido Pomar², Marie-Pierre Létourneau-Montminy¹, Patrick Schlegel³, ¹Laval University, ²Agriculture and Agri-Food Canada, ³Agroscope

Abstract: This study was performed to test the hypothesis that after a depletion period that renders replacement gilts more efficient in their use of calcium (Ca) and phosphorus (P), they can recover bone mineralization when fed a repletion diet. To this end, 24 gilts were fed according to a 2-phase feeding program (60–95 kg BW and 95–140 kg BW, respectively), corresponding to the period of depletion and repletion in Ca and P, respectively. The experimental diets for the first phase were a finisher control diet (D100; 2.1 g digestible P/kg) providing 100% of estimated Ca and P requirements or a finisher low-P diet (D60; 1.2 g digestible P/kg) providing 60% of estimated Ca and P requirements. In the second phase, one-half of the gilts from each finisher diet were randomly assigned to either a control (R100) diet or a high-P diet (R160; 3.5 g digestible P/kg) according to a 2 × 2 factorial design, resulting in 4 treatments: D60R100, D60R160, D100R100 and D100R160. Whole-body bone mineral content (BMC) and body composition of pigs were measured on each gilt at 2-week intervals by dual energy X-ray absorptiometry. Diets did not influence the growth performance throughout the experiment. At 95 kg, gilts fed D60 had reduced BMC and BMD (-9% vs D100; $P < 0.001$). At 140 kg, no significant effect of depletion diets was observed on BMC. These results show the high potential to limit dietary digestible P concentration during the growing period without causing any detrimental effects to gilts at mating, and they confirm the ability of replacement gilts to recover their BMC at 140 kg BW by increasing BMC deposition and their dietary Ca and P efficiency. Finally, high-digestible P content from 95–140 kg BW allowed gilts to increase BMC further, but required the use of dietary phosphates.

Keywords: dual-energy X-ray absorptiometry (DXA), minerals, swine

- 71 The Effect of Different Bones and Analytical Method on Assessment of Bone Mineralization Response to Dietary P, Phytase and Vitamin D in Nursery Pigs.** Hadley Williams¹, Taylor Chin¹, Jordan T. Gebhardt¹, Mike D. Tokach¹, Jason C. Woodworth¹, Joel M. DeRouchey¹, Robert D. Goodband¹, Jon R. Bergstrom², Michael Rahe³, Christopher Siepker³, Panchan Sitthicharoenchai³, ¹Kansas State University, ²DSM Nutritional Products North America, ³Iowa State University

Abstract: Three hundred-fifty pigs (initially 11.9±0.56 kg) were used to evaluate effects of different bones and analytical methods on assessment of bone mineralization response to dietary P and vitamin D in nursery pigs. Pens of pigs (5 pigs/pen) were randomized to 6 dietary treatments in a randomized complete block design with 10 pens/treatment. After feeding diets for 28-d, 8 pigs/treatment were harvested for bone analysis. Treatments were: 1) P at 0.19% STTD P (deficient), 2) P at 0.33% STTD P (NRC requirement) using monocalcium phosphate, 3) P at 0.33% STTD P including phytase, 4) P at 0.44% STTD P (industry level) using monocalcium phosphate, phytase, no vitamin D, 5) diet 4 with vitamin D (1,653 IU/kg), 6) diet 5 with additional 2,000 IU/kg 25(OH)D₃ (HyD). Final BW, ADG, and ADFI increased linearly ($P < 0.05$) and G:F improved (quadratic, $P < 0.05$) as P increased. The response to treatment for bone density and ash was dependent upon bone (density×bone interaction, $P = 0.044$; non-defatted bone ash×bone interaction, $P = 0.060$; defatted bone ash×bone interaction, $P = 0.068$). Pigs fed 0.19% STTD P had decreased ($P < 0.05$) bone density and ash (non-defatted and defatted) for all bones compared with 0.44% STTD P, with 0.33% STTD P generally intermediate or similar to 0.44% STTD P. Pigs fed 0.44% STTD P with no vitamin D had greater ($P < 0.05$) non-de-fatted fibula ash compared with all treatments other than 0.44% STTD P with added HyD. Pigs fed the 3 diets with 0.44% STTD P had greater ($P < 0.05$) de-fatted 2nd rib ash compared with pigs fed 0.19% STTD P or 0.33% STTD P with no phytase. In summary, bone density and ash responses varied depending on bone. Differences in bone density and ash in response to vitamin D and P were most apparent with fibulas and 2nd ribs.

Table 1. Effect of STTD P and vitamin D on growth performance of nursery pigs.¹

STTD P, %:	0.19	0.33	0.33	0.44	0.44	0.44	
Vitamin D, IU/kg level:	1,653	1,653	1,653	0	1,653	1,653 + 2,000 HyD	
Phytase ² :	No	No	2,000 FYT/kg	2,000 FYT/kg	2,000 FYT/kg	2,000 FYT/kg	SEM
Body weight, kg							
d 0	11.9	11.9	11.9	12.0	11.9	12.0	0.56
d 28 ³	27.0 ^a	29.3 ^b	30.1 ^b	30.4 ^b	29.8 ^b	30.3 ^b	0.94
Overall							
ADG, g ⁴	541 ^a	623 ^b	651 ^b	657 ^b	639 ^b	655 ^b	15.6
ADFI, g ⁴	919 ^a	980 ^{ab}	988 ^{ab}	1,028 ^b	1,017 ^b	1,052 ^b	30.9
G:F, g/kg ⁴	589 ^a	636 ^{bc}	660 ^c	641 ^{bc}	629 ^{bc}	627 ^b	8.2
Bone density, g/mL ⁵							
Metacarpal	1.13 ^a	1.17 ^{ab}	1.17 ^{ab}	1.20 ^b	1.19 ^b	1.19 ^b	0.014
Fibula	1.19 ^a	1.26 ^b	1.25 ^b	1.33 ^c	1.33 ^c	1.29 ^{bc}	
2 nd rib	1.15 ^a	1.22 ^b	1.26 ^{bc}	1.28 ^c	1.27 ^c	1.26 ^{bc}	
10 th rib	1.19 ^a	1.26 ^b	1.27 ^b	1.31 ^b	1.31 ^b	1.30 ^b	
Non-de-fat bone ash, % ⁶							
Metacarpal	33.9 ^a	38.8 ^b	36.8 ^b	39.0 ^b	39.1 ^b	39.1 ^b	1.02
Fibula	45.2 ^a	47.0 ^{ab}	47.4 ^{ab}	51.6 ^c	47.3 ^{ab}	49.5 ^{bc}	
2 nd rib	44.2 ^a	49.6 ^b	49.9 ^b	53.0 ^b	51.9 ^b	51.4 ^b	
10 th rib	46.2 ^a	51.3 ^b	51.6 ^b	54.3 ^b	53.7 ^b	52.2 ^b	
Defatted bone ash, % ⁷							
Metacarpal	54.0 ^a	58.5 ^b	58.3 ^b	59.7 ^b	59.1 ^b	60.0 ^b	0.72
Fibula	57.5 ^a	61.3 ^b	61.9 ^b	62.7 ^b	61.8 ^b	62.6 ^b	
2 nd rib	50.6 ^a	54.1 ^b	57.1 ^{bc}	57.9 ^c	57.8 ^c	58.4 ^c	
10 th rib	55.7 ^a	57.7 ^{ab}	58.7 ^b	59.9 ^b	58.7 ^b	58.9 ^b	

^{a-c}Means within a row with different superscript differ ($P < 0.05$).¹Pre-planned linear and quadratic contrasts were used to determine the effects of increasing levels of STTD P.²Monosyme HiPhos 2700 (DSM Nutritional Products, Parsippany, NY) was included at 2,000 FYT/kg with assumed release of 0.14 STTD P.³STTD P, quadratic, $P < 0.05$.⁴STTD P, linear, $P < 0.05$.⁵Bone density was measured on each bone based on Archimedes principle. Bone × treatment, $P = 0.044$.⁶Non-de-fat bone ash method was used to measure the percentage ash in each bone. Bone × treatment, $P = 0.060$.⁷De-fat bone ash method was used to measure the percentage ash in each bone. Bone × treatment = 0.068.

Keywords: bone mineralization, growth performance, nursery pigs

67 Effects of Monoglycerides on Growth Performance and Diarrhea of Weanling Pigs Experimentally Infected with a Pathogenic *Escherichia coli*.

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Abstract: This study aimed to investigate the effects of monoglycerides on growth performance and diarrhea of weanling pigs experimentally infected with *Escherichia coli* (*E. coli*) F18. Sixty weaned pigs [body weight (BW) = 6.49 ± 0.74 kg; around 21 d old] were individually housed and fed with 1 of 4 diets (15 replicates/diet): 1) control diet (CON); 2) CON+0.3% monoglycerides; 3) CON+3000 mg/kg ZnO and 4) CON+50 mg/kg antibiotics (carbadox). The experiment lasted 28 d with 7 d before and 21 d after first inoculation (d 0). All piglets were orally challenged with F18 *E. coli* (10^{10} CFU/3 mL) for 3 consecutive days. Growth performance was measured, and diarrhea scores were recorded daily throughout the experiment. Fecal swabs were collected on d 2, 5, 7, 10, 14, and 21 post-inoculation (PI) to estimate the percentage of β -hemolytic coliforms. Data were analyzed by ANOVA using PROC MIXED of SAS with randomized complete block design. Supplementation of ZnO increased ($P < 0.05$) BW on d 5, 14, and 21 PI, and average daily gain and average daily feed intake from d 0 to 21 PI, compared with other treatments. Both monoglycerides and antibiotics did not affect growth performance throughout the experiment. Compared with CON, supplementation of ZnO or antibiotics reduced ($P < 0.05$) the incidence and severity of diarrhea, while supplementation of monoglycerides tended to have less ($P < 0.10$) severity of diarrhea throughout the experiment. The addition of ZnO reduced ($P < 0.05$) the percentage of β -hemolytic coliforms in feces on d 5 PI compared with CON. No differences were observed in the severity of diarrhea and percentage of β -hemolytic coliforms among monoglycerides, ZnO, and antibiotics. In conclusion, dietary supplementation of 0.3% monoglycerides did not enhance growth rate but may reduce diarrhea severity of weaned pigs infected with *E. coli* F18.

Keywords: diarrhea, monoglycerides, weaned pigs