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Growth Performance of Nursery Pigs in the Immediate Post-Weaning Period According to Different Vaccination Strategies

M.B. Menegat,¹ L.L. Thomas, M.D. Tokach, J.C. Woodworth, J.M. DeRouchey, S.S. Dritz,¹ and R.D. Goodband

Summary

The objective of this study was to evaluate the growth performance of nursery pigs immediately after weaning based on different vaccination strategies. A total of 300 weaned pigs (DNA 241 × 600, DNA Genetics, Columbus, NE) with an initial body weight (BW) of 14.0 lb and approximately 21 d of age were used in this trial. Pigs were allotted to pens in a completely randomized design with 5 pigs per pen and a total of 60 pens. All pigs received one dose of a commercial combination vaccine for Porcine Circovirus Type 2 and *Mycoplasma hyopneumoniae* at approximately d 7 of age. At weaning, 30 of the 60 pens of pigs were randomly selected to receive the second dose of the vaccine. Pigs were fed common diets based on corn and soybean meal. Pigs were weighed and feed disappearance was recorded on d 0, 2, 4, 6, and 8 to determine average daily gain (ADG), average daily feed intake (ADFI), and feed-to-gain ratio (F/G). The results of this study demonstrate no evidence ($P > 0.05$) of difference for the effect of vaccination or interaction between vaccination and day on growth performance after weaning. However, there was evidence ($P < 0.0001$) for an effect of day on BW, ADG, ADFI, and F/G. In the first 2 d after weaning, pigs consumed nearly no feed and, consequently, lost weight ($P < 0.0001$). In the following days, pigs gradually increased feed intake and gained weight from d 2 to 4 ($P < 0.0001$), but lost weight from d 4 to 6 ($P < 0.0001$). A significant increase ($P < 0.0001$) in feed intake and weight gain was observed from d 6 to 8 after weaning, resulting in an increase in BW. In conclusion, weanling pigs have a slow start on feed and low growth performance during the first week after weaning, but rapidly increase feed intake and weight gain toward the end during the end of the first week of nursery. Vaccination at the moment of weaning was not an aggravating factor to post-weaning growth performance in this study.

Introduction

Weaning imposes abrupt and simultaneous stressors on pigs, including social, environmental, physiological, and nutritional factors. Moreover, management factors contrib-

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ute to an impact on post-weaning performance, in particular vaccination protocols.² As a result, the early weaning period is typically associated with low feed consumption, poor growth performance, an increase in the incidence of diarrhea, and intestinal villous atrophy.³ This post-weaning 'growth check' is considered a major limitation to production efficiency. Therefore, it is important to characterize the growth performance of newly-weaned pigs to further develop strategies to minimize the negative impact of weaning. The objective of this study was to evaluate growth performance of weaned pigs, with or without vaccination at weaning, in the immediate post-weaning period.

Procedures

The Kansas State University Institutional Care and Use Committee approved the protocol used in this experiment. The experiment was conducted at the Kansas State Swine Teaching and Research Center in Manhattan, KS. Nursery pigs were housed in 4- × 4-ft pens with a 4-hole dry self-feeder and one nipple waterer to provide *ad libitum* access to feed and water. Diets were manufactured at the Kansas State University O.H. Kruse Feed Technology Innovation Center in Manhattan, KS.

A total of 300 weaned pigs (DNA 241 × 600, DNA Genetics, Columbus, NE) with an initial BW of 14.0 lb were used in a 20-d nursery trial. Pigs were weaned at approximately 21 d of age and allotted to pens in a completely randomized design based on BW at weaning. There were 5 pigs per pen and a total of 60 pens.

All pigs received one dose of a commercially available combination vaccine for Porcine Circovirus Type 2 and *Mycoplasma hyopneumoniae* (Circumvent G2, Merck Animal Health, Summit, NJ) at approximately 7 d of age. To determine whether the second dose of the vaccine affected growth performance after weaning, 30 of the 60 pens of pigs were randomly selected to receive the second dose of the vaccine on the day of weaning.

Pigs were fed common diets based on corn and soybean meal in two dietary phases: Phase 1 was fed from d 0 to 8 in pellet form; and Phase 2 was fed from d 8 to 20 in meal form (Table 1). Pigs were weighed and feed disappearance was recorded at the same time on d 0, 2, 4, 6, and 8 to determine ADG, ADFI, and F/G during Phase 1. Pigs were also weighed on d 20 to determine BW at the end of Phase 2.

Data were analyzed using a linear mixed model testing for fixed effects of day, vaccination, and interactions. Day was analyzed as repeated measures within pen. Statistical models were fitted using the GLIMMIX procedure of SAS version 9.4 (SAS Institute Inc., Cary, NC). Pen was the experimental unit for all analysis. Results were considered significant at $P \leq 0.05$.

²Kane, E. M., Potter, M. L., Bergstrom, J. R., Tokach, M. D., DeRouchey, J. M., Goodband, R. D., Nelsen, J. L., Dritz, S. S. 2008. Effects of porcine circovirus type 2 and *Mycoplasma hyopneumoniae* vaccination timing and starter diet source on growth performance of nursery pigs. Kansas Agricultural Experiment Station Research Reports. Swine Day 2008. SRP1001. 10:1-20. <http://newprairiepress.org/kaesrr/vol0/iss10/1172/>

³Campbell, J. M., Crenshaw, J. D., Polo, J. 2013. The biological stress of early weaned piglets. J. Anim. Sci. Biotechnol. 4:19.

Results and Discussion

There was no evidence ($P > 0.05$) of difference for the effect of vaccination at weaning or interaction between vaccination at weaning and day on growth performance after weaning (Table 2). However, there was an effect ($P < 0.0001$) of day on BW, ADG, ADFI, and F/G during the period after weaning (Table 3, Figure 1). In the first 2 d after weaning, pigs consumed nearly no feed and, consequently, lost weight ($P < 0.0001$). In the following days, pigs gradually increased feed intake and gained weight from d 2 to 4 ($P < 0.0001$), but then lost weight from d 4 to 6 ($P < 0.0001$). A pronounced increase ($P < 0.0001$) in feed intake and weight gain was observed from d 6 to 8 after weaning, resulting in an increase in BW. In Phase 2, there was no evidence for difference ($P > 0.05$) in growth performance according to vaccination strategy at weaning, with mean ADG of 0.56 lb from d 8 to 20 and mean BW of 21.1 lb on d 20.

The early period following weaning is clearly a period of challenge for weaned pigs. The effects of vaccination at the moment of weaning would be considered as an aggravating factor in the post-weaning, but in this study the vaccine utilized exerted no detrimental effect on growth performance. Both vaccinated and non-vaccinated pigs increased their weaning weight by only 0.3 lb during an 8-d period into the nursery. As demonstrated in this study, pigs consumed nearly no feed during the first week after weaning and, consequently, lost 0.5 lb of BW in this period. Interestingly, toward the end of the first week of being in the nursery, pigs rapidly increased feed intake and weight gain. Moreover, pigs seemed to have adapted to the nursery diet and environment and presented adequate growth by d 20 after weaning.

As reviewed by Dong and Pluske,⁴ the factors affecting feed intake after weaning are many, including nutritional factors. Dietary approaches to improve feed consumption or minimize anorexia in the early period after weaning include using good quality ingredients, supplying the nutrient requirements, providing highly digestible diets, and improving palatability.³ Finding means to enhance feed intake in the newly-weaned pig is of utmost importance to improve growth performance, reduce post-weaning diarrhea, and prevent intestinal villous atrophy.

In conclusion, weanling pigs have a slow start on feed and low growth performance during the first week after weaning, but rapidly increase feed intake and weight gain towards the end of the first week in the nursery. Vaccination at the moment of weaning was not an aggravating factor to post-weaning growth performance in this study.

⁴Dong G. Z., Pluske, J. R. 2007. The low feed intake in newly-weaned pigs: problems and possible solutions. Asian-Aust. J. Anim. Sci. 20(3):440-452.

Table 1. Composition of diets (as-fed basis)¹

Item	Phase 1	Phase 2
Ingredient, %		
Corn	38.95	51.76
Soybean meal, 47% crude protein	17.65	29.55
Whey powder	25.00	10.00
DDGS ²	5.00	---
Fish meal	4.50	---
HP 300 ³	2.50	5.00
Choice white grease	3.00	---
Calcium carbonate	0.50	1.05
Monocalcium phosphate, 21% P	0.40	1.05
Sodium chloride	0.30	0.30
L-Lysine-HCl	0.48	0.30
DL-Methionine	0.24	0.18
L-Threonine	0.18	0.15
L-Tryptophan	0.05	---
L-Valine	0.10	---
Vitamin premix	0.25	0.25
Trace mineral premix	0.15	0.15
Vitamin E, 20,000 IU	0.05	---
Vitamin AD 10:1	0.01	---
Choline chloride 60%	0.04	---
Phytase ⁴	0.03	0.02
Zinc oxide	0.39	0.25
Sodium metabisulfate	0.25	---
Total	100.0	100.0

continued

Table 1. Composition of diets (as-fed basis)¹

Item	Phase 1	Phase 2
Calculated analysis		
Standardized ileal digestible (SID) amino acids, %		
Lysine	1.39	1.35
Isoleucine:lysine	56	63
Leucine:lysine	109	124
Methionine:lysine	37	35
Methionine and cystine:lysine	57	59
Threonine:lysine	65	66
Tryptophan:lysine	18.5	19.1
Valine:lysine	69	68
Total lysine, %	1.55	1.49
ME, kcal/lb	1,513	1,490
NE, kcal/lb	1,089	1,029
SID Lysine:NE, g/Mcal	5.78	4.11
Crude protein, %	19.5	22.8
Calcium, %	0.88	0.78
STTD P, ⁵ %	0.47	0.48

¹Diets were fed in two dietary phases: Phase 1 from d 0 to 8 in pellet form; and Phase 2 from d 8 to 20 in meal form.

²DDGS = distillers dried grains with solubles.

³Hamlet Protein, Inc., Findlay, OH.

⁴In Phase 1, Quantum Blue 5G (AB Vista North America, Plantation, FL) provided 226.8 phytase units (FTU)/lb. In Phase 2, HiPhos 2700 (DSM Nutritional Products, Inc., Parsippany, NJ) provided 184.3 FTU/lb.

⁵Standardized total tract digestible phosphorus.

Table 2. Growth performance of nursery pigs in the early period after weaning according to vaccination strategy at weaning^{1,2}

Item ^{3,4}	No vaccination, day				Vaccination, day				Probability, $P =$		
	0 to 2	2 to 4	4 to 6	6 to 8	0 to 2	2 to 4	4 to 6	6 to 8	Vaccination	Day	Vaccination × day
ADG, lb	-0.27	0.05	-0.02	0.40	-0.27	0.06	-0.03	0.43	0.692	<0.0001	0.717
ADFI, lb	0.06	0.19	0.21	0.47	0.06	0.18	0.19	0.47	0.720	<0.0001	0.825
F/G	-0.62	-0.54	0.55	1.31	-0.58	0.49	0.81	1.15	0.542	<0.0001	0.730
	d 2	d 4	d 6	d 8	d 2	d 4	d 6	d 8			
BW, lb	13.4	13.5	13.5	14.3	13.5	13.6	13.5	14.4	0.673	<0.0001	0.757

¹A total of 300 weaned pigs (DNA 241 × 600, DNA Genetics, Columbus, NE) with initial BW of 14.0 lb and 21 d of age were used in a nursery trial.

Pigs were allotted to pens in a completely randomized design with 5 pigs per pen and 30 pens per vaccination strategy.

²A total of 30 out of 60 pens of pigs were randomly selected to be vaccinated with a commercial combination vaccine for Porcine Circovirus Type 2 and *Mycoplasma hyopneumoniae* (Circumvent G2, Merck Animal Health, Summit, NJ) on the day of weaning.

³SEM range: 0.02-0.03 lb for ADG, 0.01-0.02 lb for ADFI, 0.10-1.10 for F/G.

⁴ADG = average daily gain. ADFI = average daily feed intake. F/G feed-to-gain ratio (F/G).

Table 3. Growth performance of nursery pigs in the early period after weaning^{1,2}

Item	d 0 to 2	d 2 to 4	d 4 to 6	d 6 to 8
ADG, lb	-0.27 ^d	0.06 ^b	-0.02 ^c	0.42 ^a
ADFI, lb	0.06 ^c	0.19 ^b	0.20 ^b	0.47 ^a
F/G	-0.60 ^b	-0.02 ^{ab}	0.68 ^{ab}	1.23 ^a

¹A total of 300 weaned pigs (DNA 241 × 600, DNA Genetics, Columbus, NE) with an initial BW of 14.0 lb and 21 d of age were used in a nursery trial. Pigs were allotted to pens in a completely randomized design with 5 pigs per pen and a total of 60 pens.

²There was no evidence for effect ($P > 0.05$) of vaccination or interaction between vaccination and day. There was an effect ($P < 0.0001$) of day on average daily gain (ADG), average daily feed intake (ADFI), and feed-to-gain ratio (F/G). Different superscripts indicate significant difference ($P < 0.0001$) within a row.

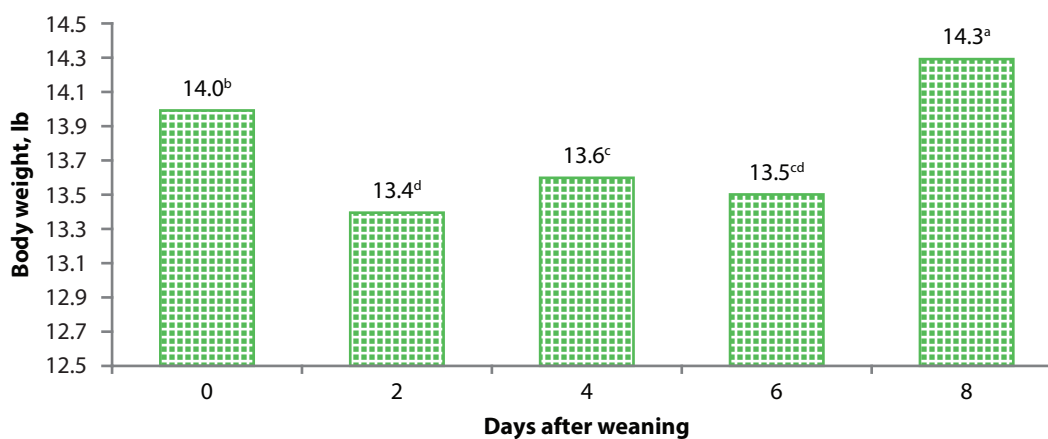


Figure 1. Body weight of nursery pigs in the first 8 days after weaning. Different superscripts indicate significant difference ($P < 0.0001$).