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Erin E. Carney
University of Nebraska-Lincoln

Huyen Tran
University of Nebraska-Lincoln

Justin W. Bundy
University of Nebraska - Lincoln, jbundy2@unl.edu

Roman Moreno
University of Nebraska-Lincoln

Philip S. Miller
University of Nebraska - Lincoln, pmiller1@unl.edu

See next page for additional authors

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Authors
Erin E. Carney, Huyen Tran, Justin W. Bundy, Roman Moreno, Philip S. Miller, and Thomas E. Burkey

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Effect of Dam Parity on Growth Performance and Immunity of Weaned Pigs

Growth performance in the nursery may be affected by dam parity.

Erin E. Carney
Huyen Tran
Justin W. Bundy
Roman Moreno
Phillip S. Miller
Thomas E. Burkey[1]

Summary

The growth performance of weaned pigs derived from different parities has not been previously evaluated; however, unpublished and anecdotal observations suggest that progeny derived from first parity (P1) dams have reduced health status and growth performance compared to progeny derived from mature sows (≥ P2). The objective of the current study was to evaluate the effect of dam parity on growth performance and immune response of P1 and P4 progeny during the nursery phase of production. Results from this experiment suggest that P4 progeny have increased body weight and growth performance during the nursery phase of production compared to P1 progeny. There were no effects of dam parity on immune response in this experiment.

Introduction

Parity segregation is used on some commercial swine farms. Parity 1 progeny are often segregated from the progeny of more mature dams (≥ P2) because of decreased growth performance and higher mortality rates. The effect of dam parity on progeny growth performance is not fully understood. However, it has been generally accepted that P1 progeny have reduced growth performance when compared to progeny of mature dams. This could be due to a lower health status in P1 progeny, causing decreased average daily gain (ADG) and increased mortality. Unpublished data suggest that P1 progeny have reduced weaning weight, decreased nursery and finishing ADG, and greater mortality than P2 progeny. The objective of the current study was to evaluate the effect of dam parity on growth performance and immune response of P1 and P4 progeny during the nursery phase of production.

Materials and Methods

Experimental Design

The experimental protocol was reviewed and approved by the Institutional Animal Care and Use committee of the University of Nebraska–Lincoln. A total of 96 weaned pigs were used in a 42-day study that is a continuation of the experiment described in a previous report (see previous article: "Effect of Dam Parity on Litter Performance and Passive Immunity"). To obtain an accurate representation of body weight (BW) as the pigs were removed from the farrowing house, BW was averaged within parity (P1 or P4), and pigs were selected based on the average BW of each parity. Initial BW of P1 and P4 pigs averaged 12.56 and 13.98 ± 0.1 lb, respectively.

Six pigs were housed in each pen with four replications per treatment. Pigs within each parity were allotted to one of two dietary treatments, a control diet (CTL) or the CTL diet with the antibiotic Mecadox (50 lb/ton; AB). This created four treatments for the nursery study, consisting of: 1) P1, CTL; 2) P1, AB; 3) P4, CTL; and 4) P4, AB (Table 1). All diets were fed in meal form and formulated to meet or exceed NRC requirements for growth. Pigs were fed in three phases: Phase I (day 0 to 7); Phase II (day 8 to 21); and Phase III (day 22 to 42). Pigs were housed in a temperature-controlled room and each pen contained a single nipple waterer and a single self-feeder to facilitate ad-libitum access to water and feed. Weight and feed disappearance were recorded on day 7, 21, and 42. Average daily gain, average daily feed intake (ADFI), and ADG:ADFI (G:F) were estimated based on the weekly pen BW and feed disappearance.

Table 1. Composition of phase 1, 2, and 3 diets (as-fed basis) %.

	Control			Antibiotics		
Ingredients (%)	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
Corn	44.4	43.9	60.2	43.4	42.9	59.2
Soybean meal, 47.5% CP	14.8	32.0	33.8	14.8	32.0	33.8
Whey, dried	22.5	15.0	0.0	22.5	15.0	0.0
Fish meal	8.0	4.0	0.0	8.0	4.0	0.0
Animal plasma	6.0	0.0	0.0	6.0	0.0	0.0
Corn oil	3.0	3.0	3.0	3.0	3.0	3.0
Dical phosphate	0.4	1.0	1.7	0.4	1.0	1.7
Limestone	0.3	0.4	0.6	0.3	0.4	0.6
Salt	0.3	0.3	0.3	0.3	0.3	0.3
Swine vit premix	0.3	0.3	0.3	0.3	0.3	0.3
Swine TM premix	0.2	0.2	0.2	0.2	0.2	0.2
L-Lysine HCl	0.0	0.0	0.0	0.0	0.0	0.0
DL-Methionine	0.1	0.0	0.0	0.1	0.0	0.0
Mecadox - 2.5 g/lb	0.0	0.0	0.0	1.0	1.0	1.0

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Table 2. Effect of dam parity and dietary treatment on average body weight (BW), average daily gain (ADG), average daily feed intake (ADFI) and feed efficiency (G:F) of weaned pigs.

	Treatments[a]					*P*-values		
Parity	1	1	4	4				
Diet	CTL	AB	CTL	AB	SEM[b]	1[c]	2[d]	3[e]
No. of pigs	24	24	24	24				
BW, lb								
day 0	12.681	2.44	14.10	13.85	0.11	0.0001	0.324	0.991
day 7	14.58	13.93	15.46	15.27	0.12	0.001	0.14	0.4
day 21	24.95	25.07	27.47	26.86	0.30	0.007	0.722	0.588
day 42	55.06	52.01	59.79	54.00	0.70	0.014	0.054	0.867
Phase 1 (day 0 to 7)								
ADG, lb	0.27	0.21	0.19	0.20	0.01	0.185	0.443	0.307
ADFI, lb	0.28	0.28	0.30	0.31	0.01	0.244	0.908	0.636
G:F, lb/lb	0.97	0.76	0.64	0.66	0.11	0.077	0.393	0.334
Phase 2 (day 8 to 21)								
ADG, lb	0.74	0.81	0.86	0.83	0.02	0.145	0.647	0.266
ADFI, lb	0.98	1.05	1.14	1.24	0.02	0.005	0.142	0.804
G:F, lb/lb	0.76	0.78	0.75	0.68	0.04	0.229	0.538	0.282
Phase 3 (day 22 to 42)								
ADG, lb	1.43	1.34	1.54	1.40	0.03	0.217	0.082	0.691
ADFI, lb	2.25	2.21	2.47	2.36	0.03	0.02	0.312	0.611
G:F, lb/lb	0.64	0.61	0.62	0.59	0.02	0.303	0.048	0.964
Overall (day 0 to 42)								
ADG, lb	1.01	0.97	1.09	1.01	0.02	0.092	0.088	0.554
ADFI, lb	1.50	1.49	1.66	1.64	0.02	0.09	0.641	0.878
G:F, lb/lb	0.68	0.65	0.65	0.61	0.02	0.087	0.07	0.588

[a]Dietary treatments included: parity 1 progeny fed the control diet (P1, CTL), parity 1 progeny fed the control diet plus antibiotic (P1, AB), parity 4 progeny fed the control diet (P4, CTL), or parity 4 progeny fed the control diet plus antibiotic (P4, AB).
[b]Standard Error of the Mean.
[c]Main effect of parity [(P1, CTL + P1, AB) vs. (P4, CTL + P4, AB)].
[d]Main effect of dietary treatment [(P1, CTL + P4, CTL) vs. (P1, AB + P4, AB)].
[e]Parity × treatment interaction.

Table 3. Frequency and serum antibody titers of pigs serologically positive for *Mycoplasma hyopneumoniae* (*M. hyo*) by the Tween 20 enzyme-linked immunosorbent assay (ELISA).

Parity	Dietary Treatment	Vaccinate or Saline Control	No. of pigs	Pigs positive (%)[a]	Tween 20 serum antibody titers (mean OD ± SEM)[b]
1	CTL	Saline	8	0	0.081
		Vaccinate	8	8 (100)	0.523
1	AB	Saline	8	0	0.077
		Vaccinate	8	7 (87.5)	0.527
4	CTL	Saline	8	0	0.075
		Vaccinate	8	8 (100)	0.452
4	AB	Saline	8	0	0.078
		Vaccinate	8	8 (100)	0.487

[a]Samples were considered positive if OD ≥ 0.24.
[b]Back-transformed geometric mean titer ± standard error of the mean (SEM).

On the day of weaning (day 0), four pigs (two barrows, two gilts) per pen were randomly chosen and vaccinated against *Mycoplasma hyopneumoniae* (*M. hyo*; RESPISURE[2]). Two pigs (one barrow, one gilt) were given the vaccine and two pigs (one barrow, one gilt) were administered a saline control. All pigs received booster vaccinations (or the appropriate saline control) at day 14 and day 28. Serum was collected from all pigs at the conclusion of the experiment (day 42) and forwarded to the University of Minnesota Veterinary Diagnostic Laboratory to be assayed for antibodies to *M. hyo* by employing the Tween 20 diagnostic assay. Titer values from two pigs (two vaccinates, two saline controls) within pens were averaged to produce a pen mean *M. hyo* titer for statistical analysis.

Statistical Analysis

Each pen was considered an experimental unit. The model was a completely randomized design. Growth data were analyzed using the MIXED procedure of SAS with dietary treatment and parity as the main effects of the model. Pen was considered as a random effect. Pig BW on day 0 was used as a covariate in the statistical analyses.

Results and Discussion

Body weight and growth performance are reported in Table 2. There was no parity × dietary treatment interaction for BW during this experiment. However, BW of P4 progeny were greater ($P < 0.02$) than P1 progeny on day 0, 7, 21, and 42 when means were averaged among dietary treatments. There were no effects of dietary treatment (CTL or AB) on BW on day 0, 7, or 21 when means were averaged among parities; however, on day 42 pigs fed the CTL diet tended to have greater ($P = 0.054$) BW than pigs fed the AB diet.

With respect to growth performance, no significant parity × dietary treatment interaction was observed for ADG, ADFI, or G:F during the entire length of the study. During Phase I, there were no significant main effects of parity or dietary treatment on ADG or ADFI; however, G:F tended ($P = 0.08$) to increase for P1 progeny compared to P4 progeny. During Phase II, there were no main effects of parity or dietary treatment on ADG or G:F; however, ADFI was greater ($P < 0.005$) for P4 progeny compared to P1 progeny. During Phase III, P4 progeny had greater ADFI compared to P1 progeny ($P < 0.02$), and pigs fed the CTL diet had greater ($P < 0.05$) G:F and tended ($P = 0.08$) to have greater ADG than pigs fed the AB diet.

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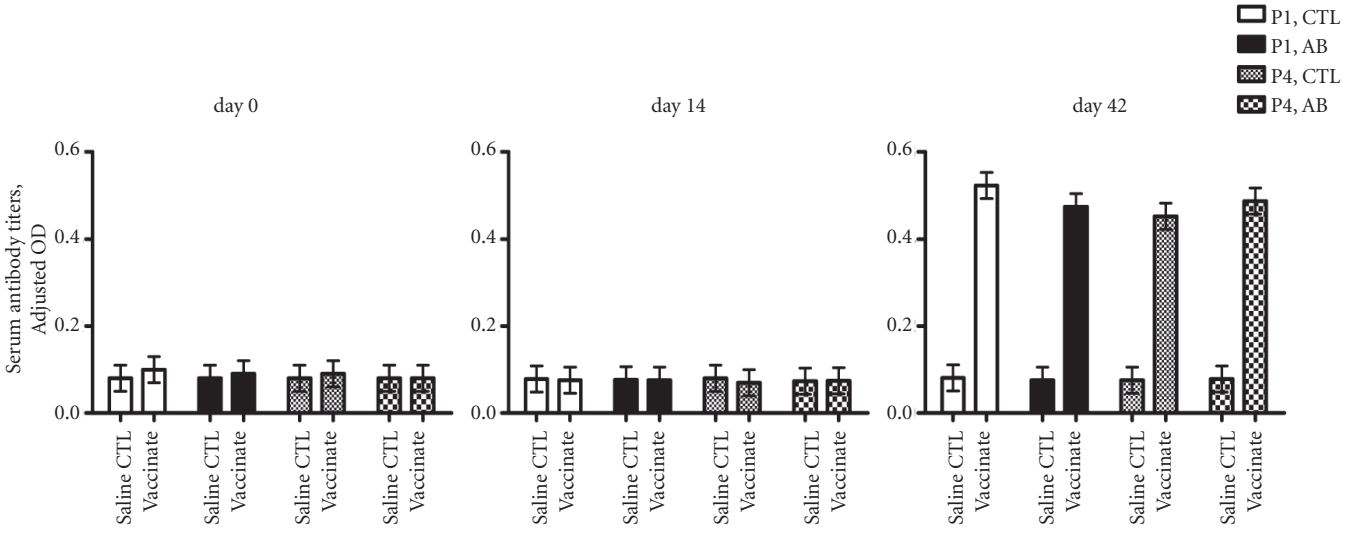

Figure 1. Mean serum antibody titers for *Mycoplasma hyopneumoniae* (*M. hyo*) by the Tween 20 enzyme-linked immunosorbent assay (ELISA) on day 0, 14 and 42 of the experiment. Each bar represents the back-transformed geometric mean titer expressed as optical density (OD) ± standard error of the mean (SEM). Dietary treatments included: parity 1 progeny fed the control diet (P1, CTL), parity 1 progeny fed the control diet plus antibiotic (P1, AB), parity 4 progeny fed the control diet (P4, CTL), or parity 4 progeny fed the control diet plus antibiotic (P4, AB).

There was no main effect of antibiotic on ADFI. Overall (day 0 to 42), P4 progeny tended ($P = 0.09$) to have greater ADG and ADFI, and decreased G:F compared to P1 progeny. In addition, pigs fed the CTL diet tended to have greater ADG ($P = 0.09$) and G:F ($P = 0.07$) compared to pigs fed the AB diet. The trend for increased growth performance in P4 progeny is consistent with previous, unpublished reports; however, the tendency for AB fed pigs to have decreased growth performance is surprising. The effect (or lack thereof) of AB on growth performance in the current study may be explained by the overall high health status of the pigs and that these pigs had been reared in an environment where an antibiotic response is not typically detected.

Mean serum antibody titers for *M. hyo* are presented in Figure 1. No pigs were serologically positive for *M. Hyo* antibody titers on day 0 or 14 of the experiment. As expected, all pigs vaccinated against *M. hyo* (with the exception of one pig) were seropositive on day 42.

The frequency and serum antibody titers of pigs serologically positive for *M. hyo* on day 42 of the experiment are presented in Table 3. There were no effects of parity, dietary treatment, or their interaction on *M. hyo* titers. These data are presented with the caveat that titers to *M. hyo* is only one means by which an immune response may be measured. Many factors may contribute to overall health status and more research may be warranted to adequately gauge immune response and overall health status among progeny derived from different parities.

Conclusion

Dam parity may affect growth performance of weaned pigs throughout the nursery period. Additional research is needed to determine the effects of dam parity on animal health in the nursery and on growth performance through the growing and finisher phases of production.

[1]Erin E. Carney, Huyen Tran, and Justin W. Bundy are graduate students; Roman Moreno is a graduate student and research technologist; Phillip S. Miller is a professor; and Thomas E. Burkey is an assistant professor in the Animal Science Department at the University of Nebraska–Lincoln.

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