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Abstract

A total of 192 weanling pigs (initially weighing 12.9 lb and 22 Â± 2 d of age, PIC) were used in a 42-d growth assay to determine the effects of phytobiotic (BiominÂ® P.E.P. 125 and 125T) addition to nursery pig diets on post-weaning growth performance. Pigs were blocked by initial weight and randomly allotted to one of four treatments: 1) negative control (feed containing no antibiotic or phytobiotic); 2) negative control + phytobiotic 1 (125 g/ton of BiominÂ® P.E.P. 125); 3) negative control + phytobiotic 2 (125 g/ton of BiominÂ® P.E.P. 125T), and 4) positive control (feed containing 140 g/ton of neomycin sulfate and 140 g/ton of oxytetracycline HCl; Neo/OTC). Each treatment had six pigs per pen and eight replications (pens). Phase 1 and Phase 2 diets were fed from d 0 to 14 and d 14 to 42 post-weaning, respectively. Pigs were weighed and feed intake was determined weekly to calculate ADG, ADFI, and F/G. Data were analyzed as a randomized complete block design using the MIXED procedure of SAS with pen as experimental unit. Overall (d 0 to 42), pigs fed Neo/OTC had greater ADG (P<0.03) and ADFI (P<0.01) than pigs fed the negative control or diets with phytobiotics. Addition of phytobiotics to the nursery diet also increased (P<0.02) daily gains (5.3 to 6.1%) and reduced (P<0.01) F/G (3.5 to 4.0%) compared to pigs fed diets without antibiotics. No differences (P>0.38) were observed in ADFI between pigs fed the negative control diet and pigs fed either phytobiotic. Pigs fed diets containing either phytobiotic had improved (P<0.01) F/G compared with pigs fed diets with Neo/OTC. However, pigs fed diets with Neo/OTC had similar (P=0.26) F/G compared to pigs fed diets without antibiotics. No differences (P>0.52) were observed in ADG, ADFI, and F/G between pigs fed diets with phytobiotic 1 and 2. In conclusion, phytobiotics in nursery diets improved post-weaning growth performance compared to pigs fed diets without antibiotics. However, the improvement in growth rate was intermediate between diets fed with and without in-feed antibiotics. Further research is needed to elucidate specific modes of action that caused positive effects in post-weaning growth and efficiency.; Swine Day, 2007, Kansas State University, Manhattan, KS, 2007

Keywords

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EFFECTS OF PHYTOBIOTICS (BIOMIN® P.E.P.) ON NURSERY PIG PERFORMANCE

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Summary

A total of 192 weanling pigs (initially weighing 12.9 lb and 22 ± 2 d of age, PIC) were used in a 42-d growth assay to determine the effects of phytobiotic (Biomin® P.E.P. 125 and 125T) addition to nursery pig diets on post-weaning growth performance. Pigs were blocked by initial weight and randomly allotted to one of four treatments: 1) negative control (feed containing no antibiotic or phytobiotic); 2) negative control + phytobiotic 1 (125 g/ton of Biomin® P.E.P. 125); 3) negative control + phytobiotic 2 (125 g/ton of Biomin® P.E.P. 125T), and 4) positive control (feed containing 140 g/ton of neomycin sulfate and 140 g/ton of oxytetracycline HCl; Neo/OTC). Each treatment had six pigs per pen and eight replications (pens).

Phase 1 and Phase 2 diets were fed from d 0 to 14 and d 14 to 42 post-weaning, respectively. Pigs were weighed and feed intake was determined weekly to calculate ADG, ADFI, and F/G. Data were analyzed as a randomized complete block design using the MIXED procedure of SAS with pen as experimental unit. Overall (d 0 to 42), pigs fed Neo/OTC had greater ADG ($P<0.03$) and ADFI ($P<0.01$) than pigs fed the negative control or diets with phytobiotics. Addition of phytobiotics to the nursery diet also increased ($P<0.02$) daily gains (5.3 to 6.1%) and reduced ($P<0.01$) F/G (3.5 to 4.0%) compared to pigs fed diets without antibiotics. No differences ($P>0.38$) were observed in ADFI between pigs fed the negative control diet and pigs fed either phytobiotic. Pigs fed diets containing either phytobiotic had improved ($P<0.01$) F/G compared with pigs fed diets with Neo/OTC. However, pigs fed diets with Neo/OTC had similar ($P=0.26$) F/G compared to pigs fed diets without antibiotics. No differences ($P>0.52$) were observed in ADG, ADFI, and F/G between pigs fed diets with phytobiotic 1 and 2. In conclusion, phytobiotics in nursery diets improved post-weaning growth performance compared to pigs fed diets without antibiotics. However, the improvement in growth rate was intermediate between diets fed with and without in-feed antibiotics. Further research is needed to elucidate specific modes of action that caused positive effects in post-weaning growth and efficiency.

(Key words: antibiotics, phytobiotics.)

Introduction

Phytobiotics, which are natural biologically active substances derived from herbs and spices, are one of the potential alternatives considered in the context of replacing in-feed antibiotics in swine diets. The viability of phytobiotic use in animal feeding stemmed from extensive clinical evidence of the potency of numerous plant extracts as antimicrobial agents. Potential effects of phytobiotics on

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immune function can be mediated either by alterations of the composition of the gut microflora or by direct effects on the gut-associated or general immune system.

Biomin® P.E.P. is a combination of phytobiotics and fructo-oligosaccharides designed to stimulate the pig's appetite through its aromatic properties, optimize digestion, and enhance the immune system through its antimicrobial and antioxidative effects. A number of field tests comparing this phytogenic blend with antibiotic growth promoters in nursery diets have shown positive effects on growth performance, but controlled experiments have been lacking. Therefore, the objective of this experiment was to determine the effects of phytobiotic (Biomin® P.E.P. 125 and 125T) addition to nursery pig diets on post-weaning growth performance.

Procedures

A total of 192 weanling pigs (initially weighing 12.9 lb and 22 ± 2 d of age, PIC) were used in a 42-d growth assay. Pigs were blocked by initial weight and randomly allotted to one of four experimental treatments. Each treatment had six pigs per pen and eight replications (pens). Each pen contained one self-feeder and one nipple waterer to provide *ad libitum* access to feed and water. Pigs were housed in the Kansas State University Swine Teaching and Research Center.

The experimental treatments were: 1) negative control (feed containing no antibiotic or phytobiotic); 2) negative control + phytobiotic 1 (125 g/ton of Biomin® P.E.P. 125); 3) negative control + phytobiotic 2 (125 g/ton of Biomin® P.E.P. 125T), and 4) positive control (feed containing 140 g/ton of neomycin sulfate and 140 g/ton of oxytetracycline HCl; Neo/OTC). A two-phase diet series was used, with a Phase 1 diet fed from d 0 to 14 and a Phase 2 diet fed from d 14 to 42 after weaning. Biomin® P.E.P. 125, Biomin® P.E.P. 125T, or the antibiotic replaced corn in the negative control diets to form the experimental treatments (Table 1). All experimental diets were fed in meal form. Pigs and feeders were weighed on day 0, 7, 14, 21, 28, 35, and 42 post-weaning to calculate ADG, ADFI, and F/G. Data were analyzed as a randomized complete block design using the MIXED procedure of SAS with pen as experimental unit.

Results and Discussion

From d 0 to 7, pigs fed diets containing Neo/OTC had greater ($P<0.02$) ADG than pigs fed the negative control diet (Table 2). This improvement in gain resulted in heavier (15.07 vs. 14.55 lb; $P<0.02$) weights at d 7. Daily gains of pigs fed diets containing phytobiotics were intermediate and not different ($P>0.13$) from pigs fed diets with either Neo/OTC or without antibiotics. There were no differences in ADFI between treatments. Moreover, pigs fed diets with Neo/OTC had better ($P<0.03$) F/G than pigs fed diets without antibiotics. Likewise, pigs on diets containing phytobiotic 2 tended to have a better ($P<0.08$) F/G than pigs fed no antibiotics. Pigs fed diets with phytobiotic 1, however, had similar ($P>0.17$) F/G to those of other treatments.

From d 0 to 14, pigs fed diets with Neo/OTC had greater ($P<0.01$) daily gains compared to both the negative control-fed pigs and the pigs fed diets with phytobiotics. Pigs fed either of the phytobiotics also had a greater ($P<0.01$) ADG than the negative controls. Daily gains were similar ($P>0.17$) between pigs fed phytobiotic 1 and 2. There were no differences ($P>0.86$) in ADFI between the pigs fed the negative control diet and pigs fed diets with either of the phytobiotics. Pigs fed diets with phytobiotic 2, however, had decreased ($P<0.01$) ADFI compared to pigs fed Neo/OTC. Pigs fed diets containing Neo/OTC had the best ($P<0.03$) F/G; however, pigs fed diets with either of the phy-

tobiotics also had better ($P<0.01$) F/G than pigs fed the control diet with no antibiotics.

From d 14 to 42, pigs fed Neo/OTC tended to have greater ($P<0.08$) ADG than pigs fed the negative control diet, with phytobiotic-fed pigs being intermediate. Pigs fed Neo/OTC had greater ($P<0.01$) ADFI than pigs fed the negative control diet or diets with either phytobiotic. There were no differences ($P>0.32$) in ADFI between the negative control and pigs fed either phytobiotic. Pigs fed the control diet without antibiotics and either of the phytobiotics had better ($P>0.01$) F/G than pigs fed diets containing Neo/OTC. No differences in ADG, ADFI, and F/G were observed between phytobiotic 1 and 2.

Overall (d 0 to 42), pigs fed Neo/OTC had greater ($P<0.04$) daily gains than pigs fed diets with no antibiotics or with phytobiotic 2. In addition, pigs fed Neo/OTC tended to have greater ($P<0.07$) ADG than pigs fed diets with phytobiotic 1. Pigs fed phytobiotic 1 and 2 also had greater ($P<0.03$) ADG than pigs fed no antibiotics. As a result, pigs fed diets with Neo/OTC had the heaviest weight at d 42, weighing 4.6 lb more (59.5 vs. 54.9 lb; $P<0.01$) than the negative controls and at least 2 lb more ($P<0.03$) than either of the phytobiotic-fed pigs. Likewise, pigs fed either phytobiotic were 2.2 lb heavier ($P<0.02$) than pigs fed the negative control diet. Pigs fed Neo/OTC had greater ($P<0.01$) ADFI than pigs fed the negative control diet or a diet with either phytobiotic. No differences ($P>0.38$) were observed in ADFI between pigs fed the negative control diet and pigs fed either phytobiotic. Pigs fed diets containing either phytobiotic had improved ($P<0.01$) F/G compared with pigs fed diets with or without antibiotics. However, pigs fed diets with Neo/OTC had similar ($P=0.26$) F/G compared to pigs fed diets without antibiotics. No differences ($P>0.52$) were observed in ADG, ADFI, and F/G between pigs fed diets with phytobiotic 1 and 2.

Results of the study demonstrate the positive effect of antibiotics in promoting growth of nursery pigs. This is consistent with previous studies conducted at the Kansas State University research farm; where pigs fed nursery diets containing Neo/OTC had greater ADG and ADFI than pigs fed the control diet with no medication post-weaning. This experiment also found that both phytobiotics improved growth performance of nursery pigs compared to a diet without antibiotics. Overall, addition of phytobiotics improved daily gains by 5.3 to 6.1% and F/G by 3.5 to 4.0% compared to pigs fed diets with no antibiotics. Pigs fed diets with antibiotics had 4.5 to 5.3% higher daily gains than those fed diets with phytobiotics, but feed efficiency of phytobiotic-fed pigs was 2.4 to 3.0% better than that of the antibiotic-fed pigs. The improvement in daily gain for pigs on diets with Neo/OTC appears to be due to the increase in ADFI compared with pigs fed the other diets (9.7% higher ADFI than pigs fed no antibiotics). No differences in ADFI were observed between pigs fed diets containing phytobiotics and diets without antibiotics. This indicates that the positive improvement in growth performance related to phytobiotic addition to the diet is an efficiency response.

In conclusion, adding phytobiotics to nursery diets improved post-weaning growth performance and can be used effectively as growth promoters in diets that do not contain antibiotics. However, this improvement in growth rate was intermediate between diets fed with or without in-feed antibiotics. Further research is needed to elucidate specific modes of action that caused positive effects in post-weaning growth and efficiency. Because the growth response observed from antibiotics was largely driven by feed intake, and the phytobiotics resulted in an efficiency response, then it is speculated that the two have different modes of action and may potentially have additive effects.

Table 1. Diet Composition (As-fed Basis)

Ingredient, %	Phase 1[a]	Phase 2[b]
Corn	51.11	59.27
Soybean meal (46.5% CP)	30.16	35.10
Spray dried whey	10.00	---
Select menhaden fish meal	3.75	---
Soy oil	1.00	1.00
Monocalcium P (21% P)	1.20	0.50
Limestone	0.75	1.10
Salt	0.35	0.35
Vitamin premix	0.25	0.25
Trace mineral premix	0.15	0.15
L-Threonine	0.15	0.15
DL-Methionine	0.13	0.13
Lysine HCl	0.30	0.30
Corn starch	0.70	---
Antibiotic[c]	---	0.70
Total	100.00	100.00
Calculated analysis		
Total lysine, %	1.55	1.45
True digestible amino acids, %		
Lysine	1.41	1.31
Isoleucine:lysine ratio	60	62
Leucine:lysine ratio	122	129
Methionine:lysine ratio	32	32
Met & cys:lysine ratio	56	57
Threonine:lysine ratio	66	67
Tryptophan:lysine ratio	17	18
Valine:lysine ratio	68	71
ME, kcal/lb	1,493	1,494
CP, %	21.9	21.4
Ca, %	0.90	0.83
P, %	0.79	0.72
Available P, %	0.50	0.39

[a]Fed from d 0 to 14 post-weaning.
[b]Fed from d 14 to 42 post-weaning.
[c]Phytobiotic 1 (125 g of Biomin® P.E.P. 125), 2 (125 g of Biomin® P.E.P. 125 T), or antibiotic (140 g/ton neomycin sulfate, 140 g/ton oxytetracycline HCl) replaced cornstarch in the control diets to provide the additional dietary treatments.

Table 2. Effects of Phytobiotics on Nursery Pig Performance[1]

	Dietary Treatment					Probability, *P*<			
Item	Negative Control	Phytobiotic 1[2]	Phytobiotic 2[3]	Neo/OTC[4]	SEM	Negative vs Neo/OTC	Negative vs Phytobiotics	Neo/OTC vs Phytobiotics	Phytobiotic 1 vs 2
Pig weight, lb									
D 0	12.91	12.90	12.91	12.91	0.02	0.61	0.99	0.56	0.31
D 7	14.55	14.79	14.77	15.07	0.21	0.02	0.22	0.12	0.90
D 28	33.18	35.22	34.69	36.52	0.70	0.0001	0.008	0.02	0.46
D 42	54.86	57.44	57.08	59.44	1.05	0.0003	0.02	0.03	0.74
D 0 to 7									
ADG, lb	0.24	0.27	0.27	0.31	0.03	0.02	0.21	0.13	0.87
ADFI, lb	0.31	0.31	0.28	0.31	0.02	0.91	0.37	0.44	0.26
F/G	1.36	1.17	1.11	1.04	0.14	0.03	0.07	0.40	0.66
D 0 to 14									
ADG, lb	0.37	0.49	0.45	0.58	0.02	<.0001	0.0002	<.0001	0.17
ADFI, lb	0.54	0.56	0.51	0.59	0.02	0.05	0.86	0.02	0.06
F/G	1.45	1.15	1.15	1.02	0.06	<.0001	<.0001	0.03	0.94
D 14 to 42									
ADG, lb	1.31	1.35	1.35	1.37	0.03	0.08	0.21	0.42	0.90
ADFI, lb	1.86	1.90	1.89	2.04	0.04	0.0004	0.32	0.0009	0.87
F/G	1.41	1.41	1.40	1.48	0.02	0.001	0.55	<.0001	0.64
D 0 to 42									
ADG, lb	1.00	1.06	1.05	1.11	0.03	0.0003	0.02	0.03	0.73
ADFI, lb	1.42	1.45	1.43	1.55	0.02	0.0003	0.38	0.0004	0.52
F/G	1.42	1.37	1.36	1.40	0.02	0.26	0.0001	0.003	0.57

[1]A total of 192 pigs (initial wt of 12.9 lb and 22 ± 2 d of age, PIC), with 6 pigs per pen and 8 replications per treatment.
[2]Provided with 125 g of Biomin® P.E.P. 125 per ton of complete feed.
[3]Provided with 125 g of Biomin® P.E.P. 125 T per ton of complete feed.
[4]Provided with 140 g of neomycin sulfate and 140 g of oxytetracycline HCl per ton of complete feed.