MANNANOLIGOSACCHARIDES IN DIETS FOR NURSERY PIGS

J.D. Hancock, C.L. Jones, and C.W. Starkey

Summary

A total of 168 pigs (average initial BW of 13.2 lb and avg initial age of 21 d) was used in a 35-d experiment to determine the effects of mannanoligosaccharides on growth performance of nursery pigs fed diets without antibiotics. Treatments were: 1) a positive control with carbadox added at 50 g/ton of diet, 2) a negative control without antibiotic, 3) the negative control with mannanoligosaccharides from dried *Saccharomyces cerevisiae* fermentation solubles (Bio-Mos added at 0.2% of the diet), and 4) the negative control diet with mannanoligosaccharides from the cell walls of yeast (Safmannan added at 0.1% of the diet).

For d 0 to 7, ADG and F/G was no better (P>0.36) for pigs fed the diet with antibiotic than the other treatments. However, this lack of difference was the result of good growth performance among pigs fed the diets with mannanoligosaccharides vs the negative control (i.e., P<0.07 for ADG and P<0.02 for F/G). For d 0 to 21 and overall (d 0 to 35), ADG was greater (P<0.02) for pigs fed diets with antibiotic vs the other treatments and for pigs fed mannanoligosaccharides vs the negative control (P<0.04). However, there were no differences in ADG, ADFI, or F/G among pigs fed diets with the two different sources of mannanoligosaccharides (P>0.49). Analyses of fecal samples indicated no effect of any treatment on fecal concentrations of total coliforms and E. coli (P>0.54).

In conclusion, we did observe a positive effect of the mannanoligosaccharides on growth performance of weanling pigs that was intermediate to the nonmedicated and medicated control diets. Those effects were not associated with changes in coliform concentrations in the feces and were most likely caused by other physiological effects.

(Key Words: Antimicrobial, Nursery Pigs, Mannanoligosaccharides)

Introduction

The effects of direct-fed microbials on animal growth and health have been of interest for many years, especially with the ever-increasing pressure to reduce (or eliminate) subtherapeutic use of antibiotics as non-specific growth promoters. A more recent thrust has been to identify naturally occurring compounds, such as certain fatty acids, peptides, and carbohydrate fractions that have biological activity of benefit to growing animals. One such group or class of compounds that now merits special interest are the mannanoligosaccharides. Thus, the experiment reported herein was designed to determine the effects of two commercially available sources of mannanoligosaccharides (fermentation solubles vs yeast cell walls) on growth performance in nursery pigs.

Procedures

A total of 168 pigs (average initial BW of 13.2 lb and 21 d of age) were used in a 35-d experiment to determine the effects of mannanoligosaccharides on growth performance of nursery pigs fed diets without antibiotics. The pigs were sorted by weight and allotted to

pens based on gender and ancestry. There were six pigs per pen and seven pens per treatment.

The diets (Table 1) were formulated to: 1.8% lysine, 0.9% Ca, and 0.8% P for d 0 to 7; 1.6% lysine, 0.8% Ca, and 0.7% P for d 7 to 21; and 1.4% lysine, 0.75% Ca, and 0.65% P for d 21 to 35. Treatments were: 1) a positive control with carbadox added at 50 g/ton of diet, 2) a negative control without antibiotic, 3) the negative control with mannanoligosaccharides from dried *Saccharomyces cerevisiae* fermentation solubles (Bio-Mos added at 0.2% of the diet), and 4) the negative control diet with mannanoligosaccharides from the cell walls of yeast (Safmannan added at 0.1% of the diet). The different inclusion amounts for the two products were to supply comparable amounts of total mannanoligosaccharides.

For d 0 to 7 and 7 to 21, the diets were steam conditioned for approximately 10 seconds at atmospheric pressure and temperatures of 140^{o}F and 160^{o}F, respectively. Pelleting was in a CPM Master Model HD1000 pellet mill equipped with a 1.25 inch thick die having holes with 5/32 inch diameter. For d 21 to 35, the diets were fed in meal form.

The pigs were housed in an environmentally controlled nursery room having 4 × 5 ft pens with wire-mesh flooring. Room temperature initially was 90^{o}F and was decreased by 3^{o}F each week thereafter. The pens had a self-feeder and nipple waterer to allow ad libitum consumption of feed and water. Pig and feeder weights were collected on d 0, 7, 21, and 35 to allow calculation of ADG, ADFI, and F/G. Additionally, fecal samples were collected (by rectal massage) from half of the pens on d 38 and the remaining half on d 39. On each day, the samples were pooled within pen and transferred immediately to a microbiology lab for determination of counts for total coliforms and E. coli.

All data were analyzed (using the GLM procedure of SAS) as a completely randomized design with gender and initial pen weight as covariates. Means were separated with the orthogonal contrasts: 1) antibiotic vs all others, 2) negative control vs mannanoligosaccharides, and 3) mannanoligosaccharides from fermentation solubles vs those from yeast cell walls.

Results and Discussion

For d 0 to 7, ADG and F/G were no better ($P>0.36$) for pigs fed the diet with antibiotic vs the other treatments. However, this lack of difference was the result of good growth performance among pigs fed the diets with mannanoligosaccharides vs the negative control (i.e., $P<0.07$ for ADG and $P<0.02$ for F/G). For the two sources of mannanoligosaccharides, ADG was not different ($P>0.39$), but F/G was improved when the mannanoligosaccharides were from the yeast cell walls ($P<0.04$).

For d 0 to 21 and overall (d 0 to 35), ADG was greater ($P<0.02$) for pigs fed diets with antibiotic vs the other treatments and for pigs fed mannanoligosaccharides vs the negative control ($P<0.04$). Pigs fed the mannanoligosaccharides had better F/G than pigs fed the negative control ($P<0.002$). However, for d 0 to 21 and 0 to 35, there were no differences in ADG, ADFI, or F/G among pigs fed diets with the different sources of mannanoligosaccharides ($P>0.49$).

In addition to the data for growth performance, we collected fecal samples to evaluate changes in the intestinal environment. There was a trend ($P<0.09$) for greater pH of the feces in pigs fed diets with the mannanoligosaccharides vs the negative control, but this change in pH did not affect counts for total coliforms and E. coli ($P>0.65$). Indeed, analyses of the fecal samples indicated no effect of any treatment on fecal concentrations of total coliforms and E. coli ($P>0.54$). Thus, it ap-

pears that the positive effects of the antibiotic and mannanoligosaccharides on growth performance were not associated with changes in the gut microflora we evaluated.

In conclusion, we did observe a positive effect of the mannanoligosaccharides on growth performance of weanling pigs that was intermediate to the nonmedicated and medicated control diets. Those effects were not associated with changes in coliform concentrations in the feces and were most likely caused by other physiological effects.

Table 1. Composition of Diets

Item	d 0 to 7	d 7 to 21	d 21 to 35
Ingredient, %			
Corn	38.95	49.44	57.93
Soybean meal	23.84	27.71	33.42
Edible grade whey	20.00	10.00	-
Spray-dried animal plasma	5.00	2.00	-
Spray-dried wheat gluten	5.00	-	-
Fishmeal	2.00	5.00	-
Soybean oil	2.00	3.50	5.00
Lysine HCl	0.38	0.21	0.31
DL-methionine	0.12	0.10	0.12
Threonine	0.07	0.07	0.11
Limestone	1.00	0.73	1.15
Monocalcium phosphate	1.06	0.53	1.22
Salt	0.20	0.30	0.35
Vitamin premix	0.25	0.25	0.25
Mineral premix	0.15	0.15	0.15
Antibiotic/mannans[a]	-	-	-
Calculated composition			
CP, %	26.3	23.4	21.1
Total lysine, %	1.80	1.60	1.40
Ca, %	0.90	0.80	0.75
Total P, %	0.80	0.70	0.65
ME, kcal/lb	1,539	1,584	1,604

[a]Provided 50 g of carbadox/ton of feed for the diets with antibiotic or 0.2% Bio-Mos or 0.1% Safmannan for the diets with mannanoligosaccharides.

Table 2. Effects of Mannanoligosaccharides on Growth Performance of Nursery Pigs[a]

Item	Antibiotic	None	Bio-Mos	Saf-mannan	SE	Contrasts[b]		
						Antibiotic vs others	None vs mannans	Bio-Mos vs Safmannan
d 0 to 7								
ADG, lb	0.54	0.45	0.51	0.55	0.03	–[c]	0.07	–
ADFI, lb	0.48	0.43	0.46	0.45	0.02	–	–	–
F/G	0.89	0.96	0.90	0.82	0.10	–	0.02	0.04
d 0 to 21								
ADG, lb	0.73	0.60	0.68	0.66	0.03	0.02	0.04	–
ADFI, lb	0.82	0.73	0.78	0.76	0.03	0.04	–	–
F/G	1.12	1.22	1.15	1.15	0.03	0.05	0.002	–
Overall (d 0 to 35)								
ADG, lb	1.01	0.87	0.94	0.94	0.02	0.002	0.04	–
ADFI, lb	1.33	1.24	1.24	1.23	0.03	0.02	–	–
F/G	1.32	1.43	1.32	1.31	0.02	0.11	0.001	–
Fecal analyses								
pH	6.00	5.87	6.00	6.01	0.06	–	0.09	–
Coliforms, $\log_{10}$	5.53	5.65	6.04	5.77	0.45	–	–	–
E. coli, $\log_{10}$	5.21	5.43	5.70	5.58	0.49	–	–	–

[a]A total of 168 pigs (six pigs per pen and seven pens per treatment) with an average initial BW of 13.2lb and an average initial age of 21 d.
[b]Contrasts were: 1) antibiotic vs all others, 2) negative control vs mannanoligosaccharides, and 3) mannanoligosaccharides from fermentation solubles (Bio-Mos) vs yeast cell walls (Safmannan).
[c]Dashes indicate P=0.15 or greater.