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Effects of mannanoligosaccharide and sodium chlorate on growth performance of nursery pigs during an acute enteric disease challenge with salmonella enterica serotype typhimurium

Abstract

A 28-day experiment was conducted to compare the effects of feeding mannanoligosaccharides (mannan) and sodium chlorate (chlorate) to weanling pigs as a possible substitute for the commonly used antimicrobial carbadox. Pigs were fed experimental diets for 2 wk, then challenged orally with *Salmonella enterica* serotype typhimurium to establish enteric disease. Average daily gain and ADFI were greater for pigs fed carbadox than all other treatments in the 2 wk following infection. During the first week after infection, pigs fed chlorate had greater G/F than control pigs, and pigs fed mannan tended to have greater G/F than control pigs. There were no differences in feed efficiency among treatments during the second week following infection.; Swine Day, Manhattan, KS, November 14, 2002

Keywords

Swine day, 2002; Kansas Agricultural Experiment Station contribution; no. 03-120-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 897; Mannanoligosaccharides; Sodium Chlorate; Antimicrobials; Weanling pigs; Swine

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EFFECTS OF MANNANOLIGOSACCHARIDE AND SODIUM CHLORATE ON GROWTH PERFORMANCE OF NURSERY PIGS DURING AN ACUTE ENTERIC DISEASE CHALLENGE WITH *Salmonella enterica* SEROTYPE TYPHIMURIUM

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Summary

A 28-day experiment was conducted to compare the effects of feeding mannanoligosaccharides (mannan) and sodium chlorate (chlorate) to weanling pigs as a possible substitute for the commonly used antimicrobial carbadox. Pigs were fed experimental diets for 2 wk, then challenged orally with *Salmonella enterica* serotype typhimurium to establish enteric disease. Average daily gain and ADFI were greater for pigs fed carbadox than all other treatments in the 2 wk following infection. During the first week after infection, pigs fed chlorate had greater G/F than control pigs, and pigs fed mannan tended to have greater G/F than control pigs. There were no differences in feed efficiency among treatments during the second week following infection.

(Key Words: Mannanoligosaccharides, Sodium Chlorate, Antimicrobials, Weanling Pigs.)

Introduction

Dietary mannan has been shown to enhance growth performance in nursery-aged swine. Mannan may also directly affect gut health in pigs. Another novel feed additive for pigs that shows promise is chlorate, which appears to be effective in reducing the pathogenesis and shedding of *Salmonella* organisms in pigs. In a

recent preliminary report, feeding weaned pigs up to 0.04 g chlorate/kg body weight reduced the number of pathogenic organisms in the intestines by 150-fold. Thus, feeding of chlorate short term appears to offer potential as a preharvest food safety tool to reduce *Salmonella* in the gastrointestinal tract of pigs prior to transport. However, the effect of chronic feeding of chlorate to pigs on growth performance and other physiological parameters has not been evaluated.

The current study was designed to evaluate growth in pigs fed mannan or chlorate prior to and after enteric disease challenge with *Salmonella enterica* serotype typhimurium. Although statistically it was possible to compare the effectiveness of mannan versus chlorate, the primary objective was to compare each of the additives individually to either feeding a diet without antimicrobial or to pigs fed diets containing the commonly fed antimicrobial carbadox.

Procedures

Weaned pigs (n=96) were blocked by weight and assigned randomly within blocks to four dietary treatments. The negative control diet contained neither of the two additives or carbadox, while the positive control contained carbadox (55 ppm; Table 1). Test diets

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contained mannan (1500 ppm) or chlorate (800 ppm). None of the diets contained other antimicrobial agents. There were 12 pens per treatment with 2 pigs/pen. Pigs were fed diets for 2 wk and then all pigs were given 1.33×10^9 CFU *S. enterica* serotype typhimurium orally and the study continued for an additional 2 wk. Body weights were obtained weekly and feed consumption was measured to estimate average daily gain (ADG), feed intake (ADFI) and feed efficiency (G/F).

Results and Discussion

During week 1 of the study, pigs fed the carbadox grew faster than pigs fed the chlorate diet ($P<0.05$), and in week 2 carbadox fed pigs had greater ADG than pigs fed the mannan or chlorate treatments ($P<0.05$; Figure 1). In week 2, this enhancement in performance was associated with increased ADFI in carbadox fed pigs ($P<0.05$). In week 3, the week following bacterial challenge, negative control pigs had reduced ADG, ADFI, and G/F compared to carbadox-fed pigs ($P<0.05$). During this same time

pigs fed chlorate had greater ADG and G/F than negative control pigs ($P<0.05$), although ADG during that time was less than carbadox-fed pigs ($P<0.05$). During week 3, pigs fed mannan tended to have improved G/F relative to negative control pigs ($P<0.07$). Pigs fed the carbadox treatment maintained greater ADG and ADFI than all other treatments during week 4.

Data from the current study are generally consistent with the growth benefits associated with feeding antimicrobials both prior to and following challenge with an enteric pathogen. In general, the pigs fed mannan and chlorate performed similarly to pigs fed no added antimicrobial. However, both mannan and chlorate tended to improve G/F in the week following bacterial challenge and this may suggest improved gut function in the face of the pathogenic insult. In addition, it is clear that this model of enteric disease provides a robust experimental setting in which to test potential alternatives to conventional antimicrobial feed additives for pigs.

Table 1. Diet Composition^a

Ingredient, %	Diet			
	Negative Control	Carbadox	Mannan	Chlorate
Corn	50.735	50.735	50.735	50.735
Soybean meal	27.94	27.94	27.94	27.94
Soy oil	3.00	3.00	3.00	3.0
Monocalcium phosphate, 21% P	1.20	1.20	1.20	1.20
Limestone	0.675	0.675	0.675	0.675
Salt	0.35	0.35	0.35	0.35
Vitamin premix	0.25	0.25	0.25	0.25
Trace mineral premix	0.15	0.15	0.15	0.15
Corn starch	1.00		0.85	0.92
Carbadox, 2.5 g/lb		1.00		
Mannan			0.15	
Sodium chlorate				0.08
Lysine HCl	0.15	0.15	0.15	0.15
DL-methionine	0.05	0.05	0.05	0.05
Select menhaden fish meal	4.50	4.50	4.50	4.50
Spray dried whey	10.00	10.00	10.00	10.00
Total	100.00	100.00	100.00	100.00

^aAll diets were formulated to contain 1.4% total dietary lysine.

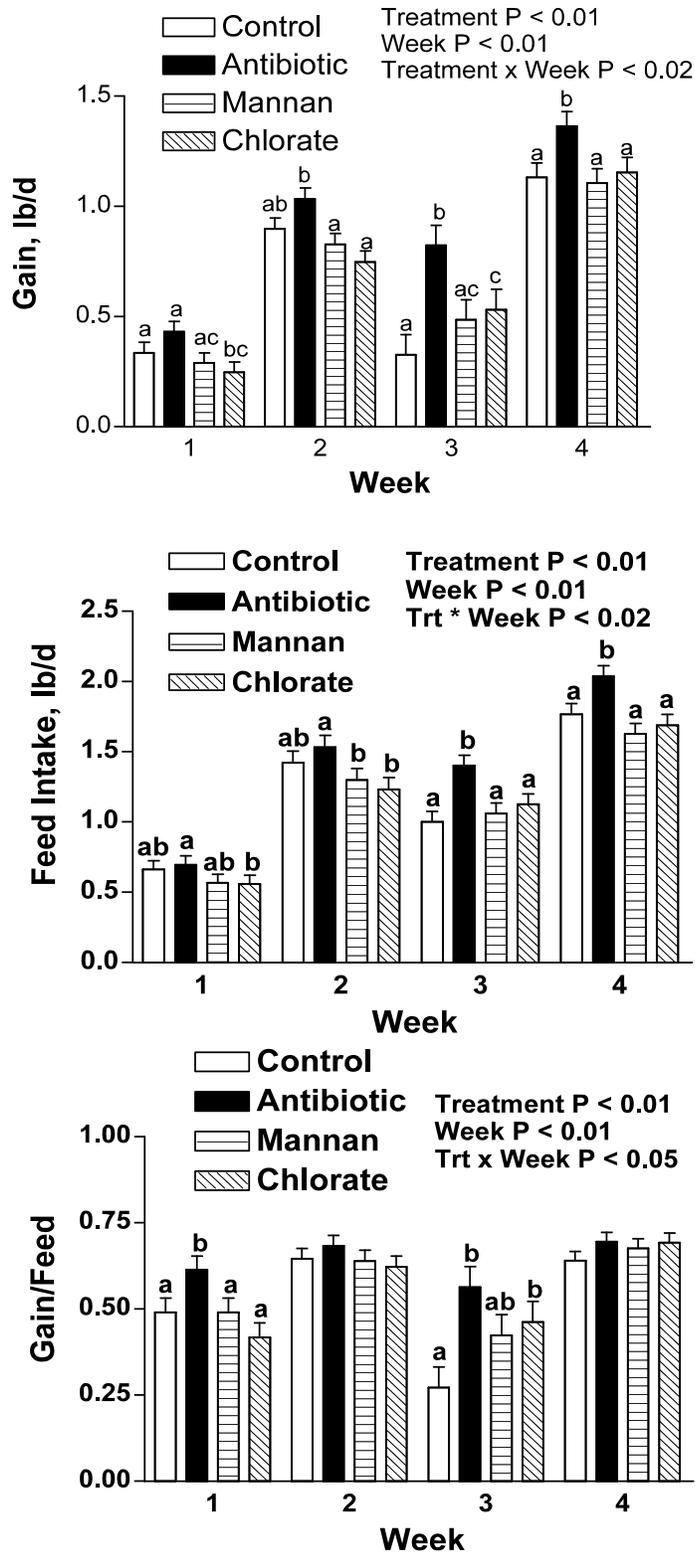


Figure 1. Growth Performance of Pigs Fed Various Dietary Additives Before (Weeks 1 and 2) and After Infection with *S. enterica* serotype typhimurium (Weeks 3 and 4). Within week, bars without common superscripts differ ($P < 0.05$).