EVALUATING CLOVES AS A POTENTIAL SUBSTITUTE FOR ANTIMICROBIALS IN NURSERY PIG DIETS [1]

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Summary

We conducted two trials to evaluate the effects of feeding graded levels of cloves to weanling pigs as a substitute for antimicrobials. In the first trial, improvements in ADG were observed in pigs fed the lowest level of clove addition (0.5%) and for those fed carbadox (50 g/ton). The higher levels of clove inclusion (1.0% and 2.0%) tended to reduce feed intake. A second trial was conducted evaluating performance of pigs fed diets containing 0.125%, 0.25% and 0.5% cloves (a different batch than used in trial 1). The was no ADG improvement from added cloves as was observed in the first trial, and the higher clove concentrations tended to reduce feed intake. The inconsistent response to added cloves between our two studies merits further investigation.

(Key Words: Clove, Spice, Antimicrobials.)

Introduction

Public concern over the routine use of in-feed antimicrobials continues to escalate. These issues are due to concerns that routine use of these antimicrobials contributes to antibiotic resistance in humans. Cloves and other spices have long been utilized as food preservatives. Many spices including cloves have significant antimicrobial activity. These established facts have prompted researchers to investigate the potential of using spices as substitutes for traditional antimicrobials in animal feeds. Therefore, our objective was to determine the effects of feeding graded levels of cloves to weanling pigs as a possible substitute for traditional antimicrobials.

Procedures

A total of 150 weanling pigs (averaging 13.9 lb in both studies) were used in each study. Pigs (PIC C22 × 326) were blocked by initial weight, and randomly allotted to one of the five dietary treatments in a randomized complete block design. Each pen contained 5 pigs, and each trial included 6 replicates (pens) per treatment.

Experimental diets were fed in meal form, and in two phases. Phase 1 diets were fed from d 0 to 7, and phase 2 diets were fed from d 7 to 28. Diets were formulated to contain 1.55 % and 1.40 % total dietary lysine for phases 1 and 2, respectively (Table 1). Dietary energy, lysine, mineral, and vitamin levels were held constant across treatments within each dietary phase, and across trials. In the experimental diets, clove or the feed antimicrobial replaced cornstarch.

Dietary treatments in Trial 1 included a negative control (no antimicrobial or cloves), a positive control (carbadox, 50 g/ton), and three levels of cloves (0.5, 1.0, and 2.0%). Trial 2 was completed with a similar treatment structure, but had clove inclusions of 0.125%, 0.25% and 0.5%. In addition, the cloves in this trial were obtained from a different lot than used in Trial 1.

[1]Appreciation is expressed to Joan Pinkas and McCormick & Co., Inc. for supplying the cloves used in these evaluations.

[2]Food Animal Health and Management Center.

Table 1. Diet Composition (As-Fed Basis)[a] %

Item	Phase 1 Basal Diet	Phase 2 Basal Diet
Corn	47.21%	51.59%
Soybean meal (46.5%)	27.56%	31.51%
Monocalcium phosphate (21% P)	1.20%	1.70%
Limestone	0.95%	0.85%
Salt	0.35%	0.35%
Vitamin premix	0.25%	0.25%
Trace mineral premix	0.15%	0.15%
Sow add pack	0.05%	0.05%
Corn starch	2.00%	2.00%
L-threonine	0.00%	0.05%
Cloves	0.00%	0.00%
Carbadox	0.00%	0.00%
Lysine HCl	0.15%	0.15%
DL-methionine	0.13%	0.10%
Spray-dried porcine plasma	5.00%	1.25%
Spray dried whey	15.00%	10.00%

[a]Clove or carbadox was provided at the expense of cornstarch to provide the clove or positive control diets.

Pigs were weighed and feed disappearance was measured weekly to determine ADG, ADFI, and F/G. Data were analyzed using GLM procedures of SAS in a randomized complete block design.

Results and Discussion

In trial 1 from d 0 to 21, ADG was improved ($P<0.05$) for the pigs fed the diet containing carbadox and the diet containing 0.5% cloves compared to those fed the negative control (Table 2). For the overall d 0 to 28 period, pigs fed 0.5% cloves tended ($P<.12$) to have better ADG and d 28 average weights compared to those fed the negative control diet. Pigs fed carbadox had increased ($P<0.04$) ADG, ADFI, and day 28 average weight compared to the negative control pigs for the overall 28-day evaluation.

Average daily gain, ADFI, and 28-day average weights decreased ($P=0.05$) in pigs fed the 2.0% clove diet compared to pigs fed either the positive or negative control diets. The reduction in feed intake at the higher levels of dietary clove inclusion may have been due to the flavors associated with cloves.

Because improvements in ADG were observed through d 21for the pigs fed the 0.5% clove treatment, we conducted a second trial with a similar design but lower levels of added cloves. Additionally, we wanted to confirm the positive response observed in pigs fed 0.5% cloves.

In trial 2, pigs fed any of the added clove treatments (0.125%, 0.25%, or 0.5%) had similar ADG, ADFI, and 28-day weights compared to those fed the negative control diet (no in-feed antimicrobial). In fact, ADFI was decreased ($P<0.05$) for the d 0 to 21 period, and tended to be decreased ($P<0.09$) for pigs fed the 0.25% and 0.5% dietary clove treatments compared to pigs fed the negative control diet. Average daily gain and the 21 d average weight were improved ($P<0.05$) for pigs fed the positive control containing carbadox compared to the negative control. However, due to the growth rate in the last 7 d of the trial, there was no improvement ($P>0.63$) for the d 0 to 28 d period for the pigs fed the positive control compared to those fed the negative control diet.

Pigs fed the positive control diet containing carbadox (50 g/ton) demonstrated im-

provement in ADG from d 0 to 21 in both trials. However, this improvement was not maintained through 28 days in the second trial. Interestingly, F/G differences were not observed between pigs fed the antimicrobial containing positive and negative control treatments in either trial. The improvements in ADG from d 0 to 21for the pigs fed the 0.5% dietary clove treatment in the initial trial were not repeated in the second evaluation. The lack of repeatability is not understood at this time.

In conclusion, substituting graded levels of cloves provided inconsistent results from d 0 to 21 post-weaning, and no benefits through 28 days after weaning. Further research is warranted to evaluate the factor(s) in spices such as cloves that may affect pig growth performance.

Table 2. Growth Performance Effects of Feeding Cloves Post-Weaning (Trial 1 Data)

	Control		Clove, %			
Item	Negative[d]	Positive[e]	0.5	1.0	2.0	SEM
d 0 to 21						
ADG, lb	0.73[a]	0.83[b]	0.82[b]	0.74[a,b]	0.66[a]	0.03
ADFI, lb	0.97[b,c]	1.06[c]	1.03[c]	0.88[a,b]	0.83[a]	0.03
F/G	1.33	1.28	1.25	1.26	1.26	0.02
d 0 to 28						
ADG	0.90[b]	0.99[c]	0.97[b,c]	0.89[a,b]	0.83[a]	0.03
ADFI	1.22[b]	1.32[c]	1.27[b,c]	1.19[b]	1.09[a]	0.03
F/G	1.35	1.33	1.32	1.33	1.33	0.02
Avg. Weight, lb						
d 0	13.9	13.9	13.9	13.9	13.9	0.03
d 21	29.2[a,b]	31.3[c]	31.1[b,c]	29.3[a,b]	27.8[a]	0.67
d 28	39.2[b]	41.7[c]	40.9[b.c]	38.9[a,b]	37.04[a]	0.75

[a,b,c]Means in the same row without a common superscript letter differ (P<0.05).
[d]No in-feed antimicrobial.
[e]Contained 55 ppm carbadox (Mecadox).

Table 3. Growth Performance Effects of Feeding Cloves Post-Weaning (Trial 2 Data)

	Control		Clove, %			
Item	Negative[c]	Positive[d]	0.125	0.25	0.50	SEM
d 0 to 21						
ADG, lb	0.74[a]	0.81[b]	0.75[a,b]	0.69[a]	0.73[a]	0.023
ADFI, lb	0.98[a]	1.00[a]	0.95[a,b]	0.87[b]	0.89[b]	0.030
F/G	1.34	1.24	1.27	1.27	1.23	0.030
d 0 to 28						
ADG, lb	0.91[a,b]	0.94[a]	0.91[a,b]	0.85[b]	0.87[b]	0.022
ADFI, lb	1.27[a,b]	1.29[a]	1.24[a,b]	1.15[b]	1.18[b]	0.034
F/G	1.39	1.37	1.36	1.36	1.35	0.023
Weight, lb						
d 0	13.9	13.9	13.9	13.9	13.9	0.02
d 21	29.4[b]	30.8[a]	29.6[a,b]	28.4[b]	29.2[b]	0.47
d 28	39.4[a,b]	40.3[a]	39.3[a,b]	37.6[b]	38.3[b]	0.61

[a,b]Means in the same row without a common superscript letter differ (P<0.05).
[c]No in-feed antimicrobial.
[d]Contained 55 ppm carbadox (Mecadox).