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The majority of the pigs in the Upper Midwest are fed a corn-soybean meal base diet. However, alternative feed ingredients are widely used in some regions. The lower performance, daily gain and efficiency of gain that is sometimes observed when other ingredients are used is often associated with higher fiber content of the diet. The pig has little ability to utilize fibrous materials in the stomach and small intestine where most digestion of feed and absorption of nutrients take place. Microorganisms present in the cecum and large intestine do break down fiber to usable products, but it is assumed that relatively small amounts of these products are absorbed. The effect that antibiotics have on fiber utilization and microbial digestion in the lower digestive tract is largely unknown.

The experiment reported herein was designed to evaluate pig performance as affected by fiber level, source of fiber and presence of antibiotics.

Experimental Procedures

Two trials were conducted utilizing 192 head of crossbred pigs. Each trial consisted of four replications of six treatments with four pigs per pen. Two barrows and two gilts were allotted to each pen on the basis of weight and ancestry. Pigs were housed in an environment-modified confinement barn having totally slatted floors. Pigs and feeders were weighed every 2 weeks and the experiment was terminated by replications when the control pen weighed 225 pounds.

The experiment consisted of three types of diets varying in ingredients and fiber content with and without antibiotics. The resulting treatments were as follows:

Treatment 1 - Control corn-soybean meal diet
Treatment 2 - Control corn-soybean meal diet plus antibiotic
Treatment 3 - 20% alfalfa meal diet
Treatment 4 - 20% alfalfa meal diet plus antibiotic
Treatment 5 - 50% oats diet
Treatment 6 - 50% oats diet plus antibiotic

The composition of the experimental diets is shown in table 1. The ingredients used resulted in calculated fiber levels of 3, 7 and 7% for the control, alfalfa and oats diets, respectively. Actual analysis revealed slightly lower fiber levels in the control and oats diets and a slightly higher fiber level in the alfalfa diet. Treatments 2, 4 and 6 contained 40 grams of aureomycin per ton of diet.

Table 1. Composition of Experimental Diets (%)

Ingredient	Treatments 1,2	3,4	5,6
Corn	82.3	67.25	36.8
Soybean meal, 44%	15.0	10.5	10.5
Dehydrated alfalfa meal, 17%	--	20.0	--
Oats	--	--	50.0
Dicalcium phosphate	1.4	1.5	1.25
Ground limestone	.6	--	.65
Trace mineralized salt, 1% zinc	.3	.3	.3
L-lysine hydrochloride	.15	.2	.25
Vitamin premix	.25	.25	.25
Calculated analysis, %[a]			
Crude protein	14.0 (14.8)	14.1 (14.8)	14.0 (15.4)
Lysine	.76	.77	.77
Crude fiber	3.0 (2.7)	7.0 (7.2)	7.0 (6.5)
Calcium	.60	.63	.60
Phosphorus	.58	.57	.56

[a] Values in parentheses were determined by chemical analysis.

Seventy-five barrows were slaughtered at the SDSU meat laboratory and routine carcass data were obtained. A sample of the content of the cecum as well as the weight of the empty cecum were obtained. Total volatile fatty acid levels as well as concentration of acetic, propionic, buteric and valeric acids were determined to evaluate digestion in the lower digestive tract and measure changes in microbial digestion due to different types of diets.

Results

The growth performance for the combined trials is shown in table 2. There were no interactions between type of diet and the presence of antibiotics. Therefore, the data are summarized by main effects (type of diet and presence of antibiotic).

Pigs which received the corn diet gained significantly faster than those receiving either the alfalfa or oats diet. This resulted in significantly heavier pigs for the corn group at the end of the trial. Pigs which received the alfalfa diet consumed significantly more feed and were less efficient than the other two groups. Numerical differences in feed consumption and feed efficiency were observed between the corn and oats fed pigs, but these differences were not significant. Antibiotics had no effect on pig performance for the 64- to 225-lb feeding period and no interactions between type of diet and presence of antibiotic were observed.

Carcass information from the barrows is shown in table 3. No differences were observed due to type of diet and the only difference due to antibiotics was in carcass length. This difference must be considered an artifact, since there is no logical association between antibiotics and skeletal growth. No interactions between type of diet and antibiotics were seen.

Table 2. Pig Performance Due to Type of Diet and Presence of Antibiotics[a]

	Diet			Antibiotics[b]	
	Corn	Alfalfa	Oats	0	+
Number of pigs	64	64	64	96	96
Starting wt, lb	64.4	65.4	65.2	64.7	65.3
Ending wt, lb[c]	224.7	212.0	210.0	215.7	215.5
Avg daily gain, lb[c]	1.69	1.56	1.50	1.56	1.60
Avg daily feed, lb[d]	5.56	6.96	5.30	5.89	5.99
Feed/gain[d]	3.25	4.48	3.53	3.76	3.75

[a] Combination of two trials.
[b] Antibiotic = 40 grams per ton aureomycin.
[c] Corn different than alfalfa and oats ($P<.05$).
[d] Alfalfa different than corn and oats ($P<.01$).

Table 3. Carcass Measurements Due to Type of Diet and Presence of Antibiotic[a,b]

	Diet			Antibiotic[c]	
	Corn	Alfalfa	Oats	0	+
Carcass wt, lb	168.3	154.3	156.5	159.9	159.7
Carcass length, in.[d]	31.7	31.4	31.5	31.3	31.7
Tenth rib backfat, in.	.91	.93	.89	.92	.92
Loin eye area, sq. in.	4.37	4.35	4.52	4.51	4.32
Percent lean	53.0	54.0	53.8	53.5	53.7

[a] Combination of two trials.
[b] All carcass data except percent lean adjusted to a constant carcass wt basis.
[c] Antibiotic = 40 grams per ton aureomycin.
[d] Antibiotic effect ($P<.01$).

Table 4 summarizes the effects of type of diet and antibiotic on volatile fatty acid levels in the cecum. No effects due to presence of antibiotics or interactions between diet and antibiotics were found. However, differences due to diet were observed for proportion of acetic, propionic and butyric acids with no difference in concentration of total volatile fatty acids. Less acetic acid and more propionic acid were found in the cecal fluids of pigs fed the corn diet. Lower butyric acid was found in the oats-fed group. This indicates that microbial digestion in the cecum was different when different feed ingredients were fed. However, the change in microbial digestion and the resulting sources of energy (volatile fatty acids) did not improve performance of pigs fed the higher fiber diets to the level of pigs fed the lower fiber diet.

Table 4. Volatile Fatty Acid Concentrations of Cecum Fluid as Related to Diet and Presence of Antibiotics[a]

	Diet			Antibiotic[b]	
	Corn	Alfalfa	Oats	0	+
Total, micromoles/milliliter	144.7	145.4	135.7	140.1	143.7
Acetic acid, %[c]	27.8	32.1	34.5	30.9	32.0
Propionic acid, %[c]	39.3	35.8	37.0	37.6	37.1
Butyric acid, %[d]	21.4	23.1	18.3	20.7	21.2
Valeric acid, %	10.8	9.4	10.8	10.9	9.9
Empty cecum wt, lb	.30	.32	.29	.31	.29

[a] Combination of two trials.
[b] Antibiotic = 40 grams per ton aureomycin.
[c] Corn different than alfalfa and oats ($P<.01$).
[d] Oats different than corn and alfalfa ($P<.01$).

Since differences in volatile fatty acids did not exist due to the presence of antibiotic, it is assumed that the types of microorganisms present in the cecum also were not significantly altered. Antibiotics appear to have no value in overcoming the problem of higher fiber content of the diet.

Summary

Two trials utilizing 192 head of pigs were conducted to evaluate performance of growing-finishing pigs fed diets which contained 0 or 7% fiber. The diets which consisted of corn-soybean meal, 20% alfalfa meal or 50% oats were fed with or without 40 grams of aureomycin per ton.

Antibiotics had no effect on any criteria evaluated and no diet by antibiotic interactions were observed. Pigs which received corn diets gained faster than pigs fed alfalfa or oats diets and pigs which received the alfalfa diet ate more feed and required more feed per unit of gain than pigs receiving corn or oats diets. Total volatile fatty acids were unaffected by diet. However, acetic acid, propionic acid and butyric acid concentrations were altered due to diet. Carcass measurements were unaffected by type of diet.

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