Botanicals for Pigs – Peppermint

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Summary and Implications

Botanicals have been proposed as a substitute for antimicrobials in swine diets because of their natural antibacterial activity. Peppermint, a botanical that grows in Iowa, was compared with a standard antibacterial nursery dietary regimen. Performance of pigs on all treatments was similar, including the positive and negative controls. At the tested inclusion levels (0, 0.5, 2.5, and 5.0%), no statistical advantage existed over the 5-week study when compared with a positive control diet with 50 g/ton Mecadox or with a negative control containing no antibacterial inclusions. Increasing levels of peppermint did not influence the muscle characteristics evaluated.

Introduction

The historic use of herbal remedies to treat and prevent infectious disease has been supplanted with the emergence of specific man-made chemotherapeutic and antibacterial agents. Selected herbs, however, are known to possess natural antibacterial activity and other characteristics that could be useful in value-added animal protein production. This area of investigation has not received substantive examination because of the relatively low costs, proven effectiveness and ready availability of synthetic growth-promoting antibacterial products. The possibility of significant antibiotic-resistant-bacterial development through the use of human drugs in animals and subsequent transfer of this resistance to human pathogens has caused concerns within the medical community. Inclusion of herbs in animal feeds as alternative growth–promotion and efficiency–stimulating strategies can address some of these concerns while producing a more holistically grown pork product.

Peppermint (*Mentha piperita*) grows under a wide range of conditions. The two most popular varieties are black peppermint (*Mentha piperita* var. *vulgaris*) and white peppermint (*Mentha piperita* var. *officinalics*). The major medicinal component of peppermint is the volatile oils found predominantly in the aerial portions of the plant. The principal components of these oils are terpenoids, menthol, methone and menthyl acetate. Pharmaceutical grade peppermint oil is produced by distillation of the fresh aerial portions harvested at the beginning of the flowering cycle and standardized to contain at least 44% free menthol and a minimum of 5% esters calculated as menthyl acetate. Other components that may have pharmaceutical properties include polyplenols, flavonoids, and betaine.

Menthol possesses carminative, antispasmodic, and cholerectic properties. It also has been recommended for treatment of the common cold. Peppermint and other members of the mint family have demonstrated significant antiviral capability (1). Peppermint also inhibits antimicrobial activity against *Streptococcus pyogenes, Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Candida albicans* (2). Treatment dosages are not well established in humans, and limited data are available for animals. An accepted human daily intake of menthol is up to 200 g/kg body weight in three divided dosages (3). Peppermint tea prepared with 1 to 2 teaspoons of dried leaves per 8 ounces of water or peppermint oil encapsulated in enteric coating at the rate of 1to 2 capsules (0.2 ml oil/capsule) three times daily have been reported in the treatment of irritable bowel syndrome. The LD_{50} of menthol in rates is 3,280 mg/kg and a fatal dose for humans was reported as one g/kg. Repeated high dosages in rats (40 mg/kg) produced dose-related brain lesions. This dosage far exceeds recommended human therapy rates (4). Hypersensitivity reactions (skin rashes) also have been reported.

Materials and Methods

The experiment was conducted at the ISU Swine Nutrition and Management Center in a temperature-regulated nursery room starting in July,1998. Eric Franzenberg, 6925 19th Av., Van Horne, IA 52346, produced the peppermint.

Ninety-five pigs were weaned at an average age of 21 days and 12.7 lb. Pigs were allotted at random to pens by litter and initial weight. Fifteen pens of five pigs each and five pens of four pigs each provided four replications of five dietary treatments. Two replicates were started on July 16, 1998, and two on July 23. Each pig was allocated approximately 12.75 lb of the respective prestarter treatment and was then switched to the starter diet treatment for the remainder of the 5-week study (Table 1). The control diet contained 50 g of Carbadox (Mecadox) per ton and the other treatments were the same diet without Carbadox. Increasing levels of peppermint (0.00, 0.50, 2.50 and 5.00%\) replaced corn. Pigs were grown in 4 x 4 ft. raised deck pens and the average room temperature was 71 ± 5°F. They were weighed and feed disappearance was determined weekly. Data were analyzed using the GLM procedure of SAS with the pen as the experimental unit.

Results and Discussion

No pigs died or were removed from the study. Reported data are cumulative from the start of the experiment. Least square means are presented in Table 2. Pigs on all treatments, including the positive and negative control pigs, performed similarly over the entire experimental period. Therefore, a response to increments of peppermint was not likely. In week 1 pigs on the 5% peppermint diet consumed significantly less feed than the Control pigs (P=.07), probably due to the lower density of the 5% peppermint diet that restricted intake. The 5% pigs in week 1 also required significantly more feed per pound of gain compared both to the controls (P=.02) and the 0.5% peppermint pigs (P=.07).

Over weeks 0–2 the 0% negative controls required significantly more feed than both the Control and the 2.5% peppermint pigs (P=.05). Generally, the positive control pigs and the added peppermint pigs performed similarly during this period. Weeks 0–3 and 0–4 suggested that the 0.5% peppermint pigs consumed more feed than 0% pigs in week 0–3 and both the 0% and 2.5% pigs weeks 0–4 (P<.10). No statistical differences were observed in the overall data (week 0–5).

Table 3 reports the results of peppermint levels on muscle quality. The ISU Department of Food Science and Human Nutrition evaluated one pig from each of the peppermint treatments. Only one pig was evaluated from each treatment and as a result no statistical data are available. Footnotes from Table 3 indicate expected values for market hogs and they may not be applicable to 40–50 lb pigs. The pH values, flavor, and off-flavor scores and Hunter Lab values were similar for all pigs. The flavor scores, 1.00-1.66 on a scale of 1 to 10, indicated not much flavor was present in these young pigs. The off-flavors were sour and liver tastes and may be more typical of immature pigs than of market-weight pigs. There appeared to be very little difference between the peppermint levels and control diets.

Nursery pigs fed different levels of peppermint failed to respond to added levels. The negative control pigs, however, performed similarly to the positive control pigs, indicating the health status of the pigs was high, or the stress levels were low.

References

1. Proc. Soc. Biol. Med. 124, p 874-875
2. Indian J. Micro 9:1, 23-24; J. Am. Pharm. Assoc. 49:11. P 692-694.
3. FAO/WHO Expert Cmte. on Food Additives. 1976. Tech. Report Service, WHO, Geneva, Switzerland
4. Can. Pharm. J., p 89-92

Table 1. Diet composition.

Prestarter

Peppermint level	Control	0.0%	0.50%	2.50%	5.00%
Corn, yellow	33.05	34.05	33.55	31.55	29.05
Soybean meal, dehulled	27.70	27.70	27.70	27.70	27.70
Peppermint	0.00	0.00	0.50	2.50	5.00
Dicalcium phosphate	1.16	1.16	1.16	1.16	1.16
Limestone	0.74	0.74	0.74	0.74	0.74
Lactose	10.00	10.00	10.00	10.00	10.00
ISU Mineral Premix	0.05	0.05	0.05	0.05	0.05
ISU Vitamin Premix	0.20	0.20	0.20	0.20	0.20
Plasma protein	5.00	5.00	5.00	5.00	5.00
Whey, dried	20.00	20.00	20.00	20.00	20.00
Soybean oil	1.00	1.00	1.00	1.00	1.00
Methionine, DL	0.10	0.10	0.10	0.10	0.10
L Lysine HCl	0.00	0.00	0.00	0.00	0.00
Mecadox 2.50	1.00	0.00	0.00	0.00	0.00
Total, %	100.000	100.00	100.000	100.00	100.00

Starter

		Peppermint level			
Peppermint level	Control	0.0%	0.50%	2.50%	5.00%
Corn, yellow	55.93	56.93	56.43	54.43	51.93
Soybean meal, dehulled	29.10	29.10	29.10	29.10	29.10
Peppermint	0.00	0.00	0.50	2.50	5.00
Dicalcium phosphate	1.51	1.51	1.51	1.51	1.51
Limestone	0.76	0.76	0.76	0.76	0.76
Salt	0.25	0.25	0.25	0.25	0.25
ISU Mineral Premix	0.05	0.05	0.05	0.05	0.05
ISU Vitamin Premix	0.20	0.20	0.20	0.20	0.20
Whey, dried	10.00	10.00	10.00	10.00	10.00
Soybean oil	1.00	1.00	1.00	1.00	1.00
Methionine, DL	0.00	0.00	0.00	0.00	0.00
L Lysine HCl	0.20	0.20	0.20	0.20	0.20
Mecadox 2.5	1.00	0.00	0.00	0.00	0.00
Total, %	100.00	100.00	100.00	100.00	100.00

Calculated analyses of control diets (%):

	Prestarter	Starter
Lysine	1.46	1.28
Methionine + cystine	0.88	0.66
Calcium	0.79	0.79
Phosphorus, total	0.72	0.70
Phosphorus, available	0.48	0.41

Table 2. Effect of peppermint on pig performance.

Peppermint	Control	0.0%	0.50%	2.50%	5.00%
Week 1					
ADG, lb	0.27	0.22	2.22	0.20	0.16
ADF, lb [a]	0.49	0.53	0.48	0.43	0.38
F/G [b]	1.85	2.54	2.22	2.46	3.18
Week 0–2					
ADG, lb	0.40	0.35	0.40	0.39	0.34
ADF, lb	0.66	0.68	0.74	0.64	0.60
F/G [c]	1.68	1.98	1.83	1.67	1.76
Week 0–3					
ADG, lb	0.50	0.44	0.51	0.52	0.46
ADF, lb [d]	0.90	0.85	0.98	0.90	0.88
F/G	1.82	1.95	1.95	1.76	1.94
Week 0–4					
ADG, lb	0.60	0.57	0.63	0.60	0.58
ADF, lb [e]	1.11	1.06	1.19	1.07	1.12
F/G	1.85	1.88	1.88	1.77	1.92
Week 0–5					
ADG, lb	0.72	0.67	0.72	0.71	0.67
ADF, lb	1.36	1.28	1.40	1.28	1.37
F/G	1.89	1.91	1.94	1.81	2.04

[a] 0.0% vs. 5.0%, P=.07
[b] Control vs. 5.0%, P=.02; 0.5% vs. 5.0%, P=0.07
[c] Control vs. 0.0%, P=.05; 0.0% vs. 2.5%, P=.05
[d] 0.0% vs. 0.5%, P=.06
[e] 0.0% vs. 0.5%, P=.08; 0.5% vs. 2.5%, P=.10

Table 3. Effect of peppermint on pig muscle.

Peppermint	0.0%	0.50%	2.50%	5.00%
pH	5.72	5.85	5.82	5.78
Cooking loss, %	22.56	27.83	26.31	24.52
Flavor score	1.33	1.00	1.66	1.33
Off-flavor score	2.00	4.33	3.33	2.33
Off-flavors	Sour Liver	Sour Liver	Sour Liver	Sour Liver
Hunter Lab L*	51.4	53.4	50.4	51.2

The pH is the ultimate pH of raw loin muscle. Low-quality loins (PSE) will have pH values as low as 5.1 and as high as 5.4. Flavor score is from 1 to 10 with low scores indicating less flavor. Off-flavor score is from 1 to 10 with low values indicating no or small off-flavors. Hunter Lab values are a measurement of the amount of lightness/darkness measured with a Hunter Lab colorimeter. The greater the values, the lighter the muscle color. Generally, lower numbers or a darker muscle color is preferred.

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