THE EFFECTS OF SUPPLEMENTING GROWING-FINISHING SWINE DIETS WITH BETAINE AND (OR) CHOLINE ON GROWTH AND CARCASS CHARACTERISTICS[1]

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Summary

Eighty crossbred gilts (initially 134 lb) were used in a growth assay to evaluate the effects of supplementing finishing pig diets with betaine and (or) choline on growth performance and carcass characteristics. Betaine at 0 or 1000 ppm and choline at 0 or 100 ppm were used in a 2 × 2 factorial arrangement in eight randomized complete blocks. A fifth treatment, 1000 ppm betaine from a liquid, 16 carbon betaine (Lonzaine - 16, distributed by Lonza, Inc., Fair Lawn, NJ), was added to further evaluate the efficacy of another form of betaine. Pigs were blocked by weight and ancestry and allotted to one of the five dietary treatments. The corn-soybean meal based experimental diets were formulated to .75% lysine, .65% Ca, and .55% P. Pigs fed the diet supplemented with betaine had higher ADG than pigs fed the control diet. The pigs fed the diet with added choline had poorer feed efficiencies and lower growth rates than pigs fed the other diets. When pigs were slaughtered at 230 lb, the pigs fed the diet with added betaine tended to have larger loin muscle areas (LMA) than the pigs fed the control diet. In conclusion, further research into the mechanisms of betaine use is needed because of the different responses that betaine has elicited in various research trials. The cost of betaine must be low enough to reap the benefits of supplementing betaine in finishing swine diets.

(Key Words: Betaine, Choline, Pigs, Finishing.)

Introduction

Recently, researchers in Australia showed that feeding betaine to gilts from 132 to 230 lb decreased backfat depth ($P < .01$). In this study, feeding betaine did not affect growth rate, feed efficiency, or dressing percent. In another study, the Australian researchers fed four levels of betaine, 0, 2, 6, or 12 lb/ton, to boars and gilts from 120 to 200 lb. As in the previous study, feeding betaine at any level did not affect growth rate, feed efficiency, or dressing percent. However, adding betaine to the gilt diet resulted in a linear decrease in backfat thickness. Boars had decreased backfat thickness when fed betaine at 2 lb/ton. Feeding betaine at 2 lb/ton resulted in 11% and 7% decreases in backfat thickness for gilts and boars, respectively. Researchers in Finland tested the efficacy of replacing choline with betaine in livestock feeds. Their research indicated that livestock feeds required 2.31 times less betaine than choline. With these results in mind, our objective was to examine the effects of supplementing finishing pig diets with betaine and (or) choline on growth performance and carcass characteristics.

Procedures

Eighty crossbred gilts (initially 134 lb) were used in a growth assay. Betaine at 0 or

[1]The authors wish to acknowledge Lonza, Inc., Fair Lawn, NJ, for partial financial support of this trial.

[2]Lonza, Inc., Fair Lawn, NJ.

1000 ppm and choline at 0 or 100 ppm were used in a 2 × 2 factorial arrangement in eight randomized complete blocks. A fifth treatment, 1000 ppm betaine from a liquid, 16 carbon betaine (Lonzaine - 16, distributed by Lonza, Inc., Fair Lawn, NJ), was added to further evaluate the efficacy of another form of betaine. Pigs were blocked by weight and ancestry and allotted to one of the five dietary treatments. The corn-soybean meal-based experimental diets were formulated to .75% lysine, .65% Ca, and .55% P and contained .1% L-Lysine HCl.

Table 1. Basal Diet Composition[a]

Item	%
Corn	82.40
Soybean meal, 46.5%	14.92
Dicalcium phosphate	1.24
Limestone	.74
Salt	.35
Cornstarch[b]	.12
Trace mineral premix	.10
Vitamin premix	.08
Antibiotic[c]	.05
Total	100.00

[a]Diets were formulated to .75% lysine, .65% Ca, and .55% P.
[b]Betaine (.10%) and choline chloride (.02%) replaced cornstarch to form three experimental diets. Betaine - C16 (1.0-%) replaced corn to form the other experimental diet.
[c]Provided 40 g/ton tylosin.

The pigs were housed at two pigs per pen in an environmentally controlled finishing barn with 4 ft × 4 ft totally slatted pens. The pens contained a single-hole feeder and a nipple waterer to allow pigs ad libitum access to feed and water. Drip coolers were activated when temperatures exceeded 80°F, cycling on 3 out of every 15 min. Pigs and feeders were weighed every 14 days to calculate ADG, average daily feed intake (ADFI), and F/G. When mean block weight reached 230 lb, all pigs within the block were slaughtered in a commercial slaughtering facility to collect standard carcass measurements.

The data from this trial were analyzed with the GLM procedure of SAS. The statistical model included the main and interactive effects of betaine and choline. Also, pigs fed the diet with the long-chain betaine product were compared to the pigs fed the control diet in a single degree of freedom contrast. One pen of pigs fed the control diet was removed from the trial because of health problems. Statistical analyses reflect this removal.

Results and Discussion

Adding betaine to the diet had a tendency to improve ($P<.07$) ADG compared to pigs fed the control diet. At the same time, a negative trend in ADG was detected ($P<.08$) when choline was added to the diet. The pigs fed the diets with supplemental choline had growth rates equal to or lower than those of the pigs fed the control diet. The pigs fed the diets with added choline had poorer feed utilization ($P<.04$) than the pigs fed the control diet.

When pigs were slaughtered at 230 lb, a trend for a betaine effect ($P<.08$) was detected for loin muscle area (LMA). No treatment differences were detected for any of the backfat measurements or percent lean or muscle.

When the pigs fed the long-chain betaine were compared the pigs fed the control diet, no differences were detected for any of the growth or carcass characteristics measured.

In conclusion, our research shows no benefit in carcass parameters from adding betaine, but the impact on growth must be further analyzed to determine the cost effectiveness of betaine. Further research is needed to explain the different responses in this trial compared to the research in Australia. Those studies never found an ADG response, and we have never found a backfat response in any of our research with betaine. The negative influence of choline on ADG and feed efficiency was surprising, since

previous research has shown no detrimental effects to supplemental choline. Because betaine and choline both act as methyl donors, further research into the level of sulfur-containing amino acids and possible interactions with betaine and choline levels in the diet is needed.

Table 2. The Effects of Betaine and (or) Choline on Finishing Pig Growth Performance[a]

Item	Control	Betaine	Choline	Bet + Chol	Betaine - C16	CV
ADG, lb[bc]	1.74	1.84	1.71	1.74	1.76	5.6
ADFI, lb	5.12	5.30	5.39	5.23	5.27	8.1
F/G[d]	2.94	2.87	3.15	3.00	2.98	7.3

[a]Means derived from 78 pigs housed at two per pen with seven or eight replicate pens per treatment.
[b]Betaine effect ($P < .07$).
[cd]Choline effect ($P < .08$, and .04, respectively).

Table 3. The Effects of Betaine and (or) Choline on Carcass Characteristics[a]

Item	Control	Betaine	Choline	Bet + Chol	Betaine - C16	CV
Backfat						
Tenth rib, in	1.17	1.23	1.20	1.11	1.14	16.6
Last rib, in	1.13	1.11	1.10	1.07	1.15	14.4
Last lumbar, in	1.01	.96	.99	.91	.98	17.2
Average, in[c]	1.24	1.23	1.26	1.19	1.25	10.3
LMA, in^{2b}	4.36	4.80	4.39	4.50	4.75	13.4
Lean, %	45.02	45.40	44.81	45.90	46.18	6.7
Muscle, %	51.08	51.10	50.88	51.69	51.75	4.1

[a]Means derived from 78 pigs slaughtered at 230 lb with 15 or 16 pigs per treatment.
[b]Betaine effect ($P < .08$)
[c]AVGBF calculated as the average of first rib, last rib, and last lumbar fat depths.
[c]Lean percent was derived from NPPC equations for carcasses with 5% fat.
[d]Muscle percent was derived from NPPC equations for carcasses with 10% fat.