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Abstract

A total of 800 pigs were used to evaluate the influence of dietary energy level on the response to betaine in finishing pig diets. Dietary treatments were arranged in a 2 Ã— 2 factorial with or without betaine and two energy density levels as the main effects. No betaine Ã— energy interactions (P>0.05) were observed for the entire feeding period (51 to 210 lb) or for any of the three dietary phases. Pigs fed the high energy diets with added fat had (P<.05) greater ADG, lower ADFI, and improved F/G compared with pigs fed the low energy diets without added fat. Adding betaine to the diet had no influence on pig performance.; Swine Day, Manhattan, KS, November 15, 2001

Keywords

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THE INFLUENCE OF DIETARY ENERGY LEVEL ON THE RESPONSE TO BETAINE [1]

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Summary

A total of 800 pigs were used to evaluate the influence of dietary energy level on the response to betaine in finishing pig diets. Dietary treatments were arranged in a 2 × 2 factorial with or without betaine and two energy density levels as the main effects. No betaine × energy interactions (P>0.05) were observed for the entire feeding period (51 to 210 lb) or for any of the three dietary phases. Pigs fed the high energy diets with added fat had (P<.05) greater ADG, lower ADFI, and improved F/G compared with pigs fed the low energy diets without added fat. Adding betaine to the diet had no influence on pig performance.

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

Introduction

Betaine is a chemical precursor to choline and similar to choline has activity biologically as a methyl donor. Research from the early 1990s from Australia indicated that pigs feeding dietary betaine had a 0.1" reduction in backfat depth. A subsequent study at K-State indicated a numerical trend for an improvement in ADG with no effect on F/G or carcass parameters. Other studies have failed to reveal a response in growth rate or carcass values when pigs were fed a corn-soy diet. A subsequent summary of betaine research indicated that a greater response to adding dietary betaine was achieved when feeding diets with lower energy content. Including betaine in a corn-soybean meal diet without added fat or choline resulted in a 7.6% improved feed efficiency (P<0.01) and increased average daily gain (P<0.01) in finishing pigs when fed for more than 38 days. Recent work reported by the University of Kentucky appears to agree with the summary, indicating that a better response was achieved when feeding lower energy diets with betaine. Therefore, the objective of this experiment was to determine if the response to added dietary betaine is influenced by the energy density of the diet.

Procedures

A total of 81,200 pigs (PIC barrows), initially weighing 51 lb, were housed in a commercial research facility in southwestern Minnesota. The barn was a 48-pen curtain-sided, total slatted finishing barn with 7.2 sq ft provided per pig and each pen initially stocked with 25 pigs. Each pen was equipped with a four-hole dry self-feeder and one cup waterer.

The finishing facility was a double curtain-sided, deep-pit barn that operated on natural ventilation during the summer and mechanical ventilation during the winter. Treatments were arranged in a 2 × 2 factorial, with or without betaine and two levels of increasing energy densities as the main effects, with seven pens per treatment. All diets were corn-soybean meal-based with

[1]Appreciation is expressed to Global Ventures for the use of pigs and facilities; and to Steve Rops, Mary Heintz, and Dr. Robert Powell for technical assistance.

[2]Food Animal Health and Management Center.

the lower energy diet containing no added fat and the high energy diet containing 5 to 6% added fat (Table 1). Betaine was included at 0.14% of the diet replacing corn in the treatment diets to obtain 1000 ppm of betaine, which was supplied by Finn Feeds International, Fenton, Missouri. Diets were fed in three phases: from 51 to 95 lb, 95 to 150 lb and 150 to 210 lb (Table 1). Each phase was fed for approximately 28 days. Vitamin and trace mineral levels were similar to KSU recommendations.

Pigs were weighed and feed disappearance was determined every 28 days. The ADG, ADFI, and F/G were determined for the performance data. Analysis of variance was used to analyze the data in a randomized complete block design using GLM procedures of SAS.

Results and Discussion

No betaine by energy interactions ($P>0.05$) were observed for the entire feeding period (51 to 210 lb) or for any of the three dietary phases (Table 2). Adding betaine to the diet did not affect pig performance; however, there was a significant response to energy density of the diet.

In phase 1, feed intake decreased ($P<0.01$) and feed efficiency improved significantly ($P<0.01$) with increasing dietary energy density. In phase 2 (95 to 150 lb), ADG was greater ($P<0.05$) for pigs fed the high-energy diet than pigs fed the low energy diet. Daily feed intake also was reduced ($P<0.05$) for pigs fed the high-energy diet leading to an improvement in feed efficiency ($P<0.01$) compared with pigs fed the low energy diet. The response in phase 3 (150 to 210 lb) was similar to the response during phase 2, with pigs fed the high-energy diet having increased ($P<0.05$) ADG and improved ($P<0.01$) F/G compared with pigs fed the low energy diet.

For the overall experiment, pigs fed the high-energy diet with added fat had higher ADG, lower ADFI, and improved F/G compared with pigs fed the low energy diets ($P<0.05$). There were no significant differences in weights at the end of phase 1 and 2, but at the end of phase 3 pigs fed the high energy density diet tended to be heavier ($P=0.087$) than those fed the low energy density diet. The responses of pigs fed the high energy diets is similar to previous research trials.

In the present trial from 50 to 210 lb, added fat resulted in 5 and 10% improvement in ADG and F/G, respectively. Energy density of the diet did not appear to influence the response to added dietary betaine. The results of this experiment failed to confirm the trends in ADG and F/G response to added fat in the diet observed with previous research at Kansas State University. Adding fat to the diet from 80 to 260 lb increased ADG and F/G by 1 and 2%, respectively, for each 1% added fat, similar to the response in this trial.

Based on the results of this experiment there appears to be little justification for adding betaine to growing-finishing swine diets. In contrast to some previous research, we failed to observe improvements in growth performance when adding betaine to corn-soybean meal diets regardless of dietary energy concentration. Energy density of the diet did not appear to influence the response to added dietary betaine. Pigs responded very favorably to the added fat in the diet in each phase, which agrees with previous research work.

Table 1. Diet Composition

	Phase 1 (51 to 95 lb)		Phase 2 (95 to 150 lb)		Phase 3 (150 to 210 lb)	
	Energy Level		Energy Level		Energy Level	
Ingredients, %	Low	High	Low	High	Low	High
Corn[a]	72.68	62.95	72.68	64.56	78.77	71.15
Soybean meal	24.61	28.36	24.61	27.76	18.79	21.43
Choice white grease	–	6.00	–	5.00	–	5.00
Monocalcium phosphate (21% P)	1.08	1.05	1.08	1.05	0.90	0.88
Limestone	0.90	0.90	0.90	0.90	0.88	0.88
Salt	0.35	0.35	0.35	0.35	0.35	0.35
Vitamin premix	0.09	0.09	0.09	0.09	0.08	0.08
Trace mineral premix	0.15	0.15	0.15	0.15	0.10	0.10
Lysine‡HCl	0.15	0.15	0.15	0.15	0.15	0.15
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis						
Lysine, %	1.11	1.20	1.12	1.19	0.89	0.95
ME, kcal/lb	1505	1628	1505	1606	1510	1613
Lysine:calorie ratio, g./mcal	3.17	3.17	3.17	3.17	2.67	2.67
Protein, %	17.6	18.5	17.6	18.4	15.4	16.0
Calcium %	0.65	0.65	0.65	0.65	0.59	0.59
Phosphorus, %	0.60	0.59	0.60	0.59	0.54	0.53
Available phosphorus, %	0.29	0.29	0.29	0.29	0.25	0.25

[a]BetaFin S6 (betaine; .14%) replaced corn in each diet to obtain the 1,000 ppm of betaine.

Table 2. Growth Performance of Pigs Fed Diets with and without Betaine at Two Different Energy Levels from 15 to 210 lb[a]

	Betaine		Probability		Energy Level		Probability	
Item	Without	With	SEM	P<	Low	High	SEM	P<
Phase 1								
ADG, lb	1.71	1.75	0.02	0.30	1.74	1.73	0.02	0.81
ADFI, lb	3.30	3.31	0.06	0.88	3.42[b]	3.19[c]	0.05	0.01
F/G	1.92	1.89	0.01	0.20	1.97[b]	1.85[c]	0.02	0.01
Phase 2								
ADG, lb	2.10	2.03	0.03	0.11	2.01[b]	2.12[c]	0.03	0.02
ADFI, lb	5.09	5.01	0.07	0.48	5.20[b]	4.90[c]	0.08	0.01
F/G	2.43	2.49	0.03	0.27	2.60[b]	2.32[c]	0.03	0.01
Phase 3								
ADG, lb	1.96	2.00	0.03	0.35	1.91[b]	2.05[c]	0.03	0.01
ADFI, lb	4.81	4.92	0.12	0.51	4.97	4.75	0.11	0.18
F/G	2.47	2.46	0.05	0.93	2.61[b]	2.32[c]	0.05	0.01
Overall								
ADG, lb	1.93	1.90	0.02	0.36	1.87[b]	1.96[c]	0.02	0.01
ADFI, lb	4.43	4.43	0.05	0.99	4.55[b]	4.31[c]	0.07	0.02
F/G	2.30	2.33	0.03	0.35	2.43[b]	2.20[c]	0.03	0.01
Weight								
D 0	50.6	51.8	1.45	0.55	51.3	51.2	1.45	0.97
D 28	95.2	97.5	1.95	0.41	96.4	96.3	1.95	0.95
D 56	152.1	152.9	2.31	0.80	151.4	153.6	2.31	0.50
D 84	208.0	209.9	2.53	0.62	205.8	212.1	2.53	0.08

[a]Mean represents a total of 800 pigs, 25 pigs/pen and 8 pens/treatment. No betaine × energy interaction (P>0.10).
[b,c]Means within a row with different superscript letter differ (P<0.05).