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Effects of added synthetic amino acids, with decreasing amounts of fat, on growth performance of growing pigs

Abstract

A total of 1,210 growing gilts (initially 102.4 lb, PIC) were used in a 28-day study in a commercial research facility to determine the effects of added synthetic amino acids, with decreasing amounts of fat, on growth performance of growing pigs. Pigs were fed one of four experimental diets based on cornsoybean meal: 1) control (3% added fat, no synthetic amino acids), 2) 2.38% added fat and high concentrations of synthetic amino acids; 3) 1.90% added fat and high concentrations of synthetic amino acids, and 4) 1.43% added fat and high concentrations of synthetic amino acids. The amounts of added fat were chosen to equalize the energy content of the diet, according to a modified ME basis, with the ME value of soybean meal being set at 95, 90, and 85% of the ME of corn in Treatments 2, 3, and 4, respectively. Overall (d 0 to 28), pigs fed diets containing high concentrations of synthetic amino acids tended to have decreased ADG ($P<0.09$) and poorer F/G ($P<0.11$) than those of pigs fed the control diet. Linear and quadratic trends for ADG, ADFI, and F/G, with decreasing amounts of added fat, were not significant. The results of this study indicate that decreasing the amount of added fat when high concentrations of synthetic amino acids are added to the diet causes a numerically reduced ADG and poorer F/G.; Swine Day, 2005, Kansas State University, Manhattan, KS, 2005

Keywords

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EFFECTS OF ADDED SYNTHETIC AMINO ACIDS, WITH DECREASING AMOUNTS OF FAT, ON GROWTH PERFORMANCE OF GROWING PIGS

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Summary

A total of 1,210 growing gilts (initially 102.4 lb, PIC) were used in a 28-day study in a commercial research facility to determine the effects of added synthetic amino acids, with decreasing amounts of fat, on growth performance of growing pigs. Pigs were fed one of four experimental diets based on corn-soybean meal: 1) control (3% added fat, no synthetic amino acids), 2) 2.38% added fat and high concentrations of synthetic amino acids; 3) 1.90% added fat and high concentrations of synthetic amino acids, and 4) 1.43% added fat and high concentrations of synthetic amino acids. The amounts of added fat were chosen to equalize the energy content of the diet, according to a modified ME basis, with the ME value of soybean meal being set at 95, 90, and 85% of the ME of corn in Treatments 2, 3, and 4, respectively. Overall (d 0 to 28), pigs fed diets containing high concentrations of synthetic amino acids tended to have decreased ADG ($P<0.09$) and poorer F/G ($P<0.11$) than those of pigs fed the control diet. Linear and quadratic trends for ADG, ADFI, and F/G, with decreasing amounts of added fat, were not significant. The results of this study indicate that decreasing the amount of added fat when high concentrations of synthetic amino acids are added to the diet causes a numerically reduced ADG and poorer F/G.

(Key Words: Added Fat, Amino Acids, Growing-Finishing Pig.)

Introduction

Several recent experiments have been conducted to evaluate the influence of added fat on the growth performance of growing-finishing pigs. In general, slight reductions in average daily gain and feed efficiency have been observed with decreasing amounts of added fat. In addition, because pigs are more energy deficient during the growing, or early-finishing phase, we would expect a greater response to the same reduction in dietary net energy when amounts of soybean meal are maintained. The use of high concentrations of synthetic amino acids to reduce the inclusion of soybean meal in diets has increased in recent years. Replacing soybean meal with synthetic amino acids increases the ME value of the diet, with the change in ME dependent on the energy value assigned to soybean meal relative to corn. The energy value of soybean meal has been suggested to be 85 to 95% of the value of corn, instead of the 99% suggested by NRC (1998). If the energy value of soybean meal was lower, larger amounts of added fat could be removed from the diet when high concentrations of synthetic amino acids are added to equalize the energy content in the diet. Therefore, the objective of this

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experiment was to further characterize the value of high concentrations of synthetic amino acids in diets with decreasing amounts of added fat in diets for growing pigs.

Procedures

A total of 1,210 growing gilts (initially 102.4 lb, PIC) were placed in a commercial research facility and randomly allotted to pens upon entry to the barn. Forty pens of approximately 26 pigs per pen were blocked by initial weight and randomly allotted to one of four dietary treatments, for a total of 10 pens per treatment.

The four experimental dietary treatments were: 1) control (3% added fat, no synthetic amino acids), 2) 2.38% added fat and high concentrations of synthetic amino acids, 3) 1.90% added fat and high concentrations of synthetic amino acids, and 4) 1.43% added fat and high concentrations of synthetic amino acids. The amounts of added fat were chosen to equalize the energy content of the diet, according to modified ME basis, with the ME value of soybean meal being set at 95, 90, and 85% of the ME of corn in Treatments 2, 3, and 4, respectively. Pigs remained on the same treatments for the entire 28-day duration of the experiment. Dietary treatments were fed in meal form (Table 1) and were formulated to contain a constant lysine-to-calorie ratio with similar amounts of vitamins and minerals.

The trial was conducted in a double curtain-sided, deep-pit, commercial research finishing facility that operated on natural ventilation during the summer and mechanical ventilation during the winter. The barn had a totally slatted floor with approximately 7.2 ft^2 provided per pig. Each pen was equipped with a four-hole dry self feeder and one cup waterer. The experiment was conducted during November. Average daily gain, ADFI, and F/G were determined by weighing pigs and measuring feeders on d 0 and 28 of the experiment. Data were analyzed as a randomized complete-block design with pen as the experimental unit. Analysis of variance was performed by using the MIXED procedure of SAS.

Results and Discussion

Overall (d 0 to 28), pigs fed the diets containing high concentrations of synthetic amino acids tended to have decreased ADG ($P<0.09$) and poorer F/G ($P<0.11$) than pigs fed the control diet had. Linear and quadratic trends for ADG, ADFI, and F/G with decreasing amounts of added fat within the synthetic amino acid diets were not significant.

Increasing concentrations of synthetic amino acids did not seem to increase the net energy of diets in this trial. The slight reduction in ADG and increase in F/G indicate that the energy values estimated by the modified ME method may have undervalued the ME value of soybean meal. It also is possible that one or more of the amino acids other than lysine became deficient when high concentrations of synthetic amino acids were added to the diet. We don't anticipate that this was a problem because all minimum ratios were maintained.

The greatest growth performance response was expected with pigs fed the diet containing the highest net energy. In this experiment, the diet that contained the highest net energy contained high concentrations of synthetic amino acids and 2.38 % fat (Treatment 2). It was surprising that pigs fed Treatment 2 had numerically lower ADG and poorer F/G than did pigs fed larger amounts of fat and lower concentrations of synthetic amino acids. Likewise, pigs fed diets containing nearly equal amounts of net energy (Treatments 1 and 4) differed greatly in growth performance (Table 2). In conclusion, the NRC ME system most accurately predicted the reduction in growth

and increase in F/G when increasing amounts of fat were removed from the diet with the inclusion of high concentrations of synthetic amino acids. Data from this trial suggest that dietary fat should not be removed when high concentrations of synthetic amino acids replace soybean meal.

Table 1. Diet Composition (As-fed Basis)

	Control	Synthetic AA		
Ingredient, % Added Fat, %:	3.00	2.38	1.9	1.43
Corn	67.02	79.40	79.92	80.44
Soybean meal (46.5% CP)	28.00	15.54	15.49	15.45
Choice white grease	3.00	2.38	1.90	1.43
Monocalcium P (21% P)	0.60	0.60	0.60	0.60
Limestone	0.85	0.85	0.85	0.85
Salt	0.35	0.35	0.35	0.35
Vitamin premix with phytase	0.08	0.08	0.08	0.08
Trace mineral premix	0.10	0.10	0.10	0.10
Isoleucine	---	0.05	0.05	0.05
L-tryptophan	---	0.03	0.03	0.03
L-threonine	---	0.15	0.15	0.15
Lysine HCl	---	0.40	0.40	0.40
DL-methionine	---	0.09	0.09	0.09
Total	100	100	100	100
Calculated analysis				
TID lysine, %	0.90	0.90	0.90	0.90
TID amino acid ratios, %				
Isoleucine:lysine ratio	78	60%	60	60
Leucine:lysine ratio	170	137	137	138
Methionine:lysine ratio	30	34	34	34
Met & Cys:lysine ratio	63	60	60	60
Threonine:lysine ratio	68	65	65	65
Tryptophan:lysine ratio	22	18	18	18
Valine:lysine ratio	88	65	65	65
Total lysine, %	1.02	0.99	0.99	0.99
ME, kcal/lb	1,577	1,570	1,560	1,550
Modified ME 95, kcal/lb[a]	1,561	1,561	1,551	1,541
Modified ME 90, kcal/lb	1,539	1,549	1,539	1,529
Modified ME 85, kcal/lb	1,517	1,537	1,527	1,517
Noblet NE, kcal/lb	1,156	1,183	1,174	1,164
CP, %	18.7	14.0	14.0	14.0
Ca, %	0.55	0.51	0.51	0.51
P, %	0.51	0.46	0.46	0.46
Available P, %	0.20	0.18	0.18	0.18
Lysine:calorie ratio, g/mcal	3.07	3.07	3.07	3.07

[a]Modified ME 95, 90, and 85 had the ME value of soybean meal at 95, 90, and 85% of the energy value of soybean meal, respectively.

Table 2. Growth Performance of Growing Pigs Fed Decreasing Amounts of Added Fat with Synthetic Amino Acids[a]

	Control	Synthetic AA			Probability, P<			
Added Fat, %:	3.00	2.38	1.90	1.43	Control vs. Synthetic	Linear[b]	Quadratic	SE
d 0 to 28								
ADG, lb	1.63	1.60	1.53	1.56	0.09	0.41	0.29	0.048
ADFI, lb	3.75	3.75	3.62	3.74	0.62	0.88	0.18	0.112
F/G	2.30	2.35	2.36	2.40	0.11	0.39	0.77	0.054

[a]Each value represents the mean of 10 pens, with approximately 26 pigs per pen. Average initial pig weight was 102.4 lb.
[b]Linear and quadratic response to change in dietary fat in the diets containing high concentrations of synthetic amino acids.