THE EFFECTS OF DIETARY ENERGY DENSITY AND LYSINE:CALORIE RATIO ON THE GROWTH PERFORMANCE OF THE 20 TO 55 LB PIG[1]

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Summary

A total of 336 barrows (initially 21.8 lb and 31 ± 2 d of age) was used to evaluate the results of increasing levels of choice white grease and lysine:calorie ratio on pig performance. Increasing levels of both choice white grease and lysine:calorie ratio improved the growth rate and efficiency of pigs fed from 20 to 55 lb.

(Key Words: Energy Density, Lysine:Calorie Ratio, Performance.)

Introduction

The recent increases in diet costs have pushed pork producers to improve the efficiency of their pigs. One way to achieve this is to increase the energy density of the diet by adding fat, traditionally soybean oil or choice white grease. Research at the University of Alberta showed that increasing the caloric content and lysine:digestible energy ratio improved feed efficiency of newly weaned pigs. Therefore, the objective of this experiment was to evaluate the effects of energy density and lysine:calorie ratio on the growth of pigs reared in a segregated early-weaning system fed from 20 to 55 lb.

Procedures

Three hundred-thirty six barrows (initially 21.8 lb and 31 ± 2 d of age) were used in a 21 d growth assay to evaluate the effects of dietary energy density and lysine:calorie ratio on growth performance. Pigs were allotted initially by weight in a 3 × 4 factorial arrangement with six replicate pens per treatment. There were four or five pigs per pen with an equal number of pigs per pen within replicate. Pigs were fed increasing levels of choice white grease (CWG; 0, 3, and 6%) and lysine:calorie ratios (3, 3.45, 3.9, and 4.35 g lysine:Mcal ME; Table 1). All diets contained .15% L-lysine HCl and were formulated to contain .80 Ca and .70% and P. Methionine and threonine levels were maintained relative to lysine with the addition of DL-methionine and L-threonine. All diets were fed in meal form. Pigs were weighed on d 7, 14, and 21 to determine ADG, ADFI, and F/G. Additionally, two pigs per pen were scanned ultrasonically on d 21 to determine tenth rib fat depth.

Data from this experiment were analyzed as a randomized complete block design using the GLM function of SAS. The main and interactive effects of energy density and lysine:calorie ratio were analyzed. Energy density and lysine:calorie ratio evaluated further using linear and quadratic polynomials. Fat depth measurements were analyzed using d 21 weight as a covariable.

Results and Discussion

From d 0 to 7, increasing the lysine:calorie ratio improved ADG and F/G (linear, $P<.001$). Also, increasing CWG improved F/G (linear, $P<.05$).

During d 7 to 14, an interaction between CWG and lysine affected ADG ($P<.01$).

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Table 1. Basal Diet Composition[a]

Ingredient	Percent
Corn	72.85
SBM (46.5% CP)	22.41
Monocalcium phosphate (21% P)	1.68
Limestone	1.08
Antibiotic	1.00
Salt	.35
Vitamin premix	.25
Trace mineral premix	.15
L-lysine HCl	.15
Copper sulfate	.08
Choice white grease[c]	--
DL-methionine	--
L-threonine	--
Total	100.00

[a]Diets were fed in the meal form.
[b]Provided 50 g/ton carbadox.
[c]Choice white greased replaced corn and SBM at 3 and 6% of the diet.

The interaction can be explained by the poor performance of the pigs fed the 3% CWG diet at 4.35 g lysine:Mcal ME. These pigs performed much more poorly than expected. However, increasing the lysine:calorie ratio increased ADFI and improved F/G (linear, $P<.01$). Adding CWG to the diet decreased ADFI and improved F/G ($P<.05$ and .001, respectively).

During the final week of the trial, pigs fed increasing CWG were more efficient (linear and quadratic, $P<.01$) and ate less feed (linear, $P<.001$). Increasing the lysine:calorie ratio increased ADFI and improved F/G (linear, $P<.02$). Average daily gain was not affected by either CWG or lysine:calorie ratio.

For the entire 21 d trial, increasing the lysine:calorie ratio resulted in pigs that grew faster and ate more feed (linear, $P<.01$). Pigs fed increasing CWG had decreased ADFI (linear, $P<.01$). Additionally, F/G improved as both CWG and lysine:calorie ratio increased (linear and quadratic, $P<.01$). Tenth rib backfat depth decreased (linear, $P<.001$) as the lysine:calorie ratio increased and was greater as CWG increased (linear, $P<.01$). This indicates that although CWG did not affect energy intake, the pigs used the increased fat as a storage component rather than an immediate energy source for lean growth.

These data indicate that CWG can be added to the phase III diet to improve feed efficiency. However, the addition of CWG, or any other fat source, must be evaluated based upon the cost of the energy compared to the gains in efficiency. Although ADG appeared to be maximized for pigs fed 3.9 g lysine/Mcal ME, F/G improved linearly through 4.35 g lysing/Mcal ME. The impact of increasing the lysine:calorie ratio also must be evaluated based upon the economic returns.

Table 2. Influence of Increasing Energy Density and Lysine:Calorie Ratio in the Diet on Pig Performance[a]

	CWG, %			g Lysine:Mcal ME[b]					Main Effects			Fat		Lysine	
Item	0	3	6	3.0	3.35	3.9	4.35	CV	Fat	Lysine	Fat × Lysine	Lin.	Quad.	Lin.	Quad.
Day 0 to 7															
ADG. lb	1.17	1.14	1.19	1.04	1.13	1.25	1.24	10.4	.3703	.0001	.4829	.741	.1722	.0001	.0974
ADFI, lb	1.72	1.66	1.65	1.69	1.66	1.70	1.65	8.7	.2007	.6516	.7535	.4638	.5876	.5665	.7040
F/G	1.48	1.47	1.40	1.64	1.48	1.36	1.33	8.8	.0485	.0001	.7233	.0244	.3116	.0001	.0452
Day 7 to 14															
ADG, lb	1.39	1.39	1.44	1.30	1.39	1.47	1.46	7.5	.1082	.0001	.0067	.0619	.3364	.0001	.0491
ADFI, lb	2.23	2.16	2.13	2.21	2.22	2.19	2.08	6.6	.0854	.0173	.1001	.0318	.5664	.0082	.0802
F/G	1.63	1.56	1.49	1.70	1.60	1.49	1.43	7.2	.0004	.0001	.4993	.0001	.9984	.0001	.4235
Day 14 to 21															
ADG, lb	1.49	1.53	1.49	1.44	1.55	1.49	1.53	9.8	.6149	.1843	.8547	.9239	.3287	.2034	.3911
ADFI, lb	2.64	2.44	2.37	2.58	2.48	2.51	2.38	8.5	.0002	.0487	.5708	.0001	.2368	.0123	.7043
F/G	1.78	1.59	1.60	1.79	1.61	1.67	1.56	8.8	.0001	.0001	.7975	.0001	.0144	.0002	.3177
Day 0 to 21															
ADG, lb	1.35	1.35	1.37	1.26	1.35	1.40	1.41	5.3	.4508	.0001	.0638	.2946	.4737	.0001	.0021
ADFI, lb	2.20	2.08	2.05	2.16	2.12	2.12	2.03	5.6	.0002	.0173	.2598	.0001	.1173	.0035	.4512
F/G	1.63	1.54	1.50	1.71	1.57	1.51	1.44	3.1	.0001	.0001	.4177	.0001	.031	.0001	.002
Fat depth, in	.303	.310	.328	.331	.322	.308	.294	14.0	.0199	.0066	.0643	.0071	.4601	.0005	.6966

[a]Means derive from 336 barrows (initially 21.8 lb) housed at four or five pigs per pen with six replicate pens per treatment.
[b]Mcal ME = megacalorie of metabolizable energy.