INFLUENCE OF DIETARY LYSINE ON CARCASS CHARACTERISTICS OF HIGH-LEAN GROWTH GILTS FED FROM 80 TO 160 LB[1]

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Summary

Seventy-two high-lean growth gilts (initially 75.5 lb BW) were used to determine the influence of dietary lysine on carcass characteristics at 120 and 160 lb. Gilts were randomly selected for slaughter when the average weight of pigs in the pen equaled or exceeded 120 and 160 lb. The experiment was designed as a randomized complete block, with initial weight serving as the blocking factor. Six dietary treatments were included, ranging from .54 to 1.04% digestible lysine (.69 to 1.25% total dietary lysine). At 120 lb, hot carcass weight decreased and then increased as did dressing percentage for gilts fed increased dietary lysine. Average backfat thickness and 10th rib fat depth were not influenced by dietary treatment. However, longissimus muscle area (loineye) was increased for gilts fed greater dietary lysine. Kidney fat and total carcass lipid decreased but carcass moisture increased as dietary lysine increased. The decreased carcass lipid content resulted in reduced longissimus muscle marbling at 120 lb. For gilts fed to 160 lb, hot and chilled carcass weight decreased and then increased as dietary lysine increased. Dressing percentage followed a similar pattern because of the difference in carcass weight. Backfat thickness, 10th rib fat thickness, and kidney fat decreased for gilts fed increased dietary lysine. Carcass moisture and crude protein increased and then decreased as dietary lysine increased. The moisture content was maximal for gilts fed .94% digestible lysine, whereas carcass crude protein was maximal for gilts fed .74% digestible lysine. However, carcass lipid followed an opposite pattern, decreasing and then increasing as dietary lysine increased. Carcass muscle score improved but longissimus muscle marbling decreased for gilts fed greater dietary lysine. The data from this experiment suggest that the high-lean growth gilt requires at least 18 and 22 g/d lysine intakes from 80 to 120 and from 120 to 160 lb, respectively, to optimize longissimus muscle area and minimize carcass lipid content.

(Key Words: Pigs, Genotype, Gilts, Carcass Characteristics.)

Introduction

The emphasis on carcass leanness over the past 5 years has led producers to purchase seed stock from proven genetic sources selected for a high rate of lean deposition. However, improper amino acid and energy nutrition can actually mask the pig's genetic potential. Research from the University of Kentucky has indicated the relationship between lysine intake (crude protein) and genetic potential. The data suggest that pigs selected for a greater rate of lean deposition require increased dietary lysine and energy to sustain increased muscle deposition and increased maintenance requirements. By increasing dietary

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lysine, loin eye area is increased while backfat thickness is decreased, indicating a shift in the composition of weight gain from lipid to muscle tissue. By incorporating lean value marketing programs, the increased muscle deposition can result in greater profit margins for the producer. Thus, the relationship between nutrition and genetic potential must be considered throughout both the growing and finishing phases of growth for both improvements in growth performance and carcass leanness. Therefore, the objective of this experiment was to determine the influence of dietary lysine on carcass characteristics of high-lean growth gilts fed from 80 to 120 and 160 lb.

Procedures

The experimental design and procedures are described in the previous paper. Briefly, 108 (initially 75.5 lb) high-lean growth pigs were housed three pigs/pen with six replicate pens/treatment. Six dietary treatments were fed ranging from .54 to 1.04% digestible lysine (.68 to 1.25% total lysine), increasing by an increment of .1%. The pigs were housed in an open-fronted building with solid concrete flooring. Each pen contained a single hole feeder and a nipple waterer to provide *ad libitum* access to feed and water. When the mean weight of pigs in pen reached 120 and 160 lb, one pig/pen was randomly selected for slaughter to determine carcass characteristics.

Carcass Characteristics. Carcasses were weighed immediately following slaughter and reweighed 24 h postmortem to record hot and chilled carcass weights, respectively. Dressing percentage was determined from the live weight and the hot carcass weight. The kidney fat was removed from each carcass following slaughter and weighed. Backfat thickness was measured at the first and last ribs and last lumbar vertebrae from both the right and left sides of the carcass. All six measurements were averaged to determine the average backfat thickness. Tenth-rib fat depth was measured at 3/4 the length from the midline of the longissimus muscle. Longissimus muscle area at the 10th rib was traced and read with a planimeter. Carcass color, firmness, marbling, and muscle scores were recorded according to NPPC (1991) guidelines. The muscle score index was expanded from a scale of one to three points to a scale of one to six points. The expanded scale set a mid-point at three and allowed for more accurate estimates of carcass muscle.

Results

At 120 lb, live weight and chilled carcass weight were not influenced (P=.69) by dietary lysine (Table 1). However, hot carcass weight tended to decrease and then increase (quadratic, P<.10), resulting in a similar trend in dressing percentage (quadratic, P<.10). Gilts fed increasing dietary lysine levels had a similar average backfat thickness (P=.28) and 10th rib fat depth (P=.21). However, average backfat thickness and 10th rib fat depth numerically decreased for gilts fed increased dietary lysine compared to gilts fed .54% digestible lysine. Dietary lysine positively influenced (linear, P<.05) longissimus muscle area, increasing by .64 in^2 when digestible lysine was increased from .54 to 1.04%. Carcass length was not influenced (P=.39) by dietary treatment. The amount of kidney fat decreased (linear, P<.01) as digestible lysine increased. Carcass moisture was increased (linear, P<.01) and carcass lipid decreased (linear, P<.01) for gilts fed increased dietary lysine. However, carcass crude protein and ash were not influenced (P=.57) by increasing digestible lysine. Visual scores for muscling (P=.15), longissimus color (P=.49), and longissimus firmness (P=.92) were not affected by dietary treatment. However, longissimus marbling tended to decrease (linear, P<.10) for gilts fed increased digestible lysine.

When gilts were slaughtered at 160 lb, live weight was not affected by dietary treatment (Table 2). However, hot and chilled carcass weights were greater (quadratic, P<.05) for gilts fed a .74% digestible lysine diet than a .54 or 1.04% digestible lysine diet. This resulted in increased (quadratic, P<.05) dressing percentage for gilts fed .74% digestible lysine. Average backfat thickness and 10th rib fat depth were decreased (linear, P<.01) for gilts fed increased digestible lysine. Gilts fed 1.04% digestible lysine had .19 and .15 in less average backfat and 10th rib fat depth, respectively, than gilts fed .54% digestible lysine. Longissimus muscle area (P=.20) and carcass length (P=.52) were not influenced by digestible lysine. Kidney fat decreased (linear, P<.01) as digestible lysine increased, resulting in a .57 lb decrease in kidney fat for gilts fed 1.04% compared with .54% digestible lysine. Moisture and crude protein were greater (linear, P<.01; quadratic P<.05) for gilts fed increased digestible lysine. Carcass moisture and crude protein appeared to be maximized for gilts fed between .74 and .94% digestible lysine. Carcass lipid decreased (linear, P<.01) for gilts fed increased digestible lysine. Quality scores for carcass muscling increased (linear, P<.01) and those for marbling decreased (linear, P<.05) as digestible lysine increased from .54 to 1.04% digestible lysine. Longissimus color (P=.94) and firmness (P=.74) scores were not influenced by dietary treatment.

Discussion

As dietary lysine increased from 80 to 120 lb, longissimus muscle area increased but average backfat thickness was not influenced. The carcass composition at 120 lb had decreased lipid content as exemplified by a numerical decrease in backfat thickness and a dramatic decrease in kidney fat. This would suggest a shift in the composition of gain towards a greater lean content. Even though the percentage of protein in the carcass did not increase, the amount of lipid was reduced. This can be explained by the tissue accretion rates described in the previous paper (p. 85), indicating a greater rate of protein and a reduced rate of lipid deposition. Muscle scores also indicate that increased dietary lysine resulted in improved carcass muscling. Although carcasses are not traditionally sold at 85 lb, the carcass quality (color and firmness) did not indicate poorer muscle quality as dietary lysine increased. Also, longissimus muscle marbling was decreased in gilts fed increased dietary lysine

At 160 lb, longissimus muscle area was improved only numerically by increased dietary lysine. However, average and tenth rib backfat thickness were decrease for gilts fed increased dietary lysine. These data again suggest a shift in the composition of gain towards greater muscle deposition. Although crude protein content of the carcasses was not affected by dietary lysine, carcass lipid content decreased and moisture content increased. These shifts in composition would reflect the change in the composition of gain. The decreased lipid content can be explained by decreased backfat thickness and kidney fat weight. Longissimus muscle color and firmness were not influenced by dietary lysine; however, longissimus muscle marbling was decreased. This decrease in marbling would correspond to the decreased carcass lipid.

The results of this experiment suggest that high-lean growth gilts fed from 80 to 120 and 160 lb require at least 18 and 22 g/d, respectively, of lysine intake to maximize carcass leanness and minimize carcass lipid. In our previous paper, we showed that with increasing dietary lysine, total gain was increased (p. 85). In conjunction, the composition of gain was shifted towards greater muscle deposition and decreased lipid deposition. These data further suggested the importance of phase feeding grower pigs diets matched to their genetic potential for optimimal carcass leanness and minimal carcass lipid deposition and, thus, more fully capitalizing on lean value marketing programs.

Table 1. The Effect of Increased Digestible Lysine on Carcass Characteristics, Composition, and Quality in High-Lean Growth Gilts Slaughtered at 120 lb[a]

	Digestible Lysine, %						
Item	.54	.64	.74	.84	.94	1.04	CV
Live wt, lb	120.56	120.56	121.04	118.88	120.05	119.88	2.89
Hot carcass wt, lb[b]	84.49	84.39	80.73	83.69	83.39	83.85	2.04
Chilled carcass wt, lb	82.15	82.09	79.63	82.27	81.88	81.28	2.69
Dressing percentage[b]	69.90	69.85	66.83	69.21	69.01	69.40	2.05
Average backfat thickness, in	.59	.54	.39	.52	.48	.50	19.52
Tenth rib fat depth, in	.45	.59	.33	.42	.34	.49	24.28
Longissimus muscle area, in^2 [c]	3.40	3.70	3.35	3.56	4.00	4.04	9.30
Carcass length, in	25.67	26.08	26.42	25.88	25.38	25.76	2.31
Kidney fat, lb[d]	.61	.48	.42	.63	.30	.36	21.94
Carcass composition, %							
Moisture[d]	61.82	63.80	65.08	64.53	65.51	66.41	5.44
CP (N × 6.25)	17.15	17.67	18.40	17.95	17.89	17.87	6.32
Lipid[d]	14.62	12.63	11.30	11.70	11.30	9.84	13.98
Ash	3.12	2.87	3.23	3.07	2.82	3.07	11.24
Quality							
Muscle score[e]	4.38	3.20	4.44	4.89	4.64	4.58	18.43
Marbling[fg]	2.10	1.57	1.28	1.43	1.59	1.22	31.50
Color[f]	2.44	1.79	2.40	2.00	2.36	2.16	19.84
Firmness[f]	2.86	2.55	2.25	3.05	2.73	2.53	31.73

[a]Calculated from 36 pigs at a pen mean weight of 120 lb, one pig/pen, six pigs/treatment.
[b]Quadratic effect of digestible lysine ($P<.10$).
[c]Linear effect of digestible lysine ($P<.05$).
[d]Linear effect of digestible lysine ($P<.01$).
[e]Carcasses were evaluated on a six point scale ranging from thin muscling (1) to extremely thick muscling (6).
[f]Loins were evaluated on a five point scale according to NPPC (1991) procedures.
[g]Linear effect of digestible lysine ($P<.10$).

Table 2. The Effect of Increased Digestible Lysine on Carcass Characteristics, Composition, and Quality in High-Lean Growth Gilts Slaughtered at 160 lb[a]

	Digestible Lysine, %						
Item	.54	.64	.74	.84	.94	1.04	CV
Live wt, lb	164.00	159.66	161.16	159.02	161.84	158.67	3.36
Hot carcass wt, lb[b]	111.21	110.69	117.35	114.46	115.14	111.24	2.67
Chilled carcass wt, lb[b]	109.09	108.53	115.31	111.95	112.46	109.28	2.90
Dressing percentage[b]	68.67	68.34	72.49	70.71	71.12	68.68	2.71
Backfat thickness, in[c]	.69	.71	.59	.53	.51	.50	11.10
Tenth rib fat depth, in[c]	.55	.61	.56	.38	.39	.46	18.66
Longissimus muscle area, in^2	4.88	4.55	5.48	5.25	5.14	5.17	7.75
Carcass length, in	28.40	28.18	28.11	27.89	28.24	27.90	1.49
Kidney fat, lb[c]	1.04	.87	.71	.57	.47	.47	27.23
Carcass composition, %							
Moisture[bc]	59.91	61.12	61.98	64.05	64.52	62.72	3.12
CP (N × 6.25)[bc]	16.71	16.99	18.76	18.37	18.10	18.10	5.37
Lipid[cd]	16.23	14.68	12.45	11.53	11.40	12.37	15.68
Ash	3.17	3.44	3.33	3.36	2.66	3.34	12.05
Quality							
Muscle score[ce]	3.61	3.29	5.70	5.08	5.20	5.36	16.55
Marbling[fg]	1.72	1.43	1.21	1.51	1.00	1.19	19.91
Color[g]	1.94	1.87	1.80	2.00	2.04	1.93	16.40
Firmness[g]	2.09	1.85	1.99	2.27	2.34	2.47	26.89

[a]Calculated from 36 pigs at a pen mean weight of 160 lb, one pig/pen, six pigs/treatment.
[b]Quadratic effect of digestible lysine ($P<.05$).
[c]Linear effect of digestible lysine ($P<.01$).
[d]Quadratic effect of digestible lysine ($P<.01$).
[e]Carcasses were evaluated on a six point scale ranging from thin muscling (1) to extremely thick muscling (6).
[f]Linear effect of digestible lysine ($P<.05$).
[g]Loins were evaluated on a five point scale according to NPPC (1991) procedures.