INTERACTIVE EFFECTS BETWEEN PAYLEAN™ (RACTOPAMINE HCL) AND DIETARY LYSINE ON PORK QUALITY, LOIN, BELLY, AND HAM COMPOSITION [1]

M. J. Webster, R. D. Goodband, M. D. Tokach, J. A. Unruh, J. L. Nelssen, S. S. Dritz [2], D. E. Real, J. M. DeRouchey, J. C. Woodworth, and T. A. Marsteller [3]

Summary

A total of 432 pigs were used to evaluate the effects of Paylean and dietary lysine on pork quality and loin, belly, and ham composition. The 12 dietary treatments included Paylean (0, 4.5, and 9.0 g/ton) and 4 levels of lysine. For pigs fed no Paylean, lysine levels were 0.60, 0.80, 1.00, and 1.20%. For pigs fed 4.5 or 9.0 g/ton of Paylean, lysine levels were 0.80, 1.00, 1.20, and 1.40%. The results indicate that pigs fed Paylean and increasing levels of lysine will have less loin marbling and belly firmness compared to control pigs fed lower levels of lysine.

(Key Words: Paylean, Lysine, Finishing Pigs, Pork Quality.)

Introduction

Paylean has been shown to increase protein and decrease fat accretion resulting in a faster growing, leaner pig. Also, adding lysine to the diet can have the same effects on protein and fat accretion. However, this effect could lead to undesirable pork quality and could alter composition in the loin, belly, and ham. The objectives of this experiment were to evaluate the interactive effects of dietary lysine and Paylean dosage on pork quality and loin, belly, and ham composition.

Procedures

Four hundred thirty-two pigs (PIC 326 × C22) averaging 175 lb were used in this experiment. The experiment was divided into two identical trials, the first beginning in October 2000, and the second starting in February 2001. The procedures used were identical for the two trials. Pigs were housed with three per pen and 12 pens (1.5 × 1.5 m) per treatment (six pens of barrows and six pens of gilts) in a randomized complete block design. Pigs were blocked by initial weight and sex, then randomly allotted to one of the 12 experimental treatments. Feed and water were provided ad libitum.

The experiment was arranged in an incomplete 3 × 4 factorial. Main effects included Paylean dosage (0, 4.5 and 9 g/ton) and dietary lysine. For control pigs, diets contained 0.60, 0.80, 1.00, and 1.20% total lysine and for pigs fed Paylean, diets contained 0.80, 1.00, 1.20, and 1.40% total lysine. Details on diet composition are provided in the previous report on page 77. The dietary treatments were fed from 175 to 240 lb.

At the beginning of the trial, pigs were randomly assigned either to a midpoint slaughter (d 14), ending slaughter (d 28) or as an alternate in case a pig was removed due

[1]The authors wish to thank Elanco Animal Health, a division of Eli Lilly Corporation, Indianapolis, IN, for funding the experiment.

[2]Food Animal Health and Management Center.
[3]Elanco Animal Health, Indianapolis, IN.

to death, sickness, or being 2 standard deviations from treatment mean. One pig per pen was processed at the KSU Meat Lab on d 14 (midpoint) and 28 (end) of the trial. At 24 h postmortem, carcasses were fabricated into the primal cuts for further data collection. Following a 30 minute bloom, the loin surface at the 10th rib was analyzed for color (Hunter L*a*b* values), drip loss, ultimate pH, visual color, firmness and marbling.

Longissimus muscle color was evaluated on a scale of 1 to 5 with 1 representing a muscle that was pale pinkish-gray and 5 representing a dark-purplish red color. Marbling was evaluated on a scale of 1 to 5 with 1 being practically devoid and 5 being moderately abundant or greater. Longissimus muscle firmness ranged from 1 to 5 with 1 representing very soft and watery lean and 5 representing very firm and dry lean. After visual scores, Minolta color spectrophotometry data (CIE L*, a*, and b* values) were obtained in duplicate from the same chop. These values then were used to calculate a:b ratio, hue angle, wavelength, and saturation index. The Minolta L* value represents the lightness of the sample. Longissimus muscles with a higher L* value would be lighter in color. Minolta a* values are chromatic coordinates representing a change from green to red color. A higher a* value indicates a sample with more red color. Minolta b* values are also chromatic coordinates, representing a change in color from blue to yellow. The higher b* value, the more yellow the sample is in color. The a:b ratio indicates a change in redness. The higher the ratio, the darker red the color. The hue angle represents the change from red to an orange color; therefore, a larger hue angle corresponds to less red color in the sample. The chroma, or the total color of the sample is expressed as the saturation index. The greater the value of the saturation index, the more intense the color of the sample. The wavelength is a ratio between the wavelength values of 630 and 580. It represents a ratio of reflectance or the amount of oxymyoglobin present. The higher the ratio, the more oxymyoglobin present.

After evaluating color, the chops were dissected and a 1-cu in. sample was taken to determine drip loss. Samples were weighed and suspended on a fishhook inside a sealed container at 6°C for 24 hours. Then, they were removed from the sealed containers and weighed again to determine percent drip loss.

After spareribs were removed and the belly trimmed, belly firmness was evaluated by suspending the belly perpendicularly over a bar (skin side up) and the distance was recorded between the belly ends initially and after a five-minute period. Higher values represent firmer bellies. A sample from each loin (9th rib), ham (biceps femoris), and belly, from the same anatomical region on every pig, was collected, frozen, and later analyzed for protein, lipid, and moisture content for the measurement of tissue composition. Data were analyzed using the GLM procedure of SAS.

Results

Pork Quality. For the midpoint pork quality data (Table 1), there was a significant trial x treatment interaction for L* values. For the L* interaction, increasing dietary lysine decreased L* values in control pigs in trial 2, but not in trial 1.

As Paylean dosage increased, loin visual color score (quadratic, $P<0.01$) and a* and b* values (linear, $P<0.01$) decreased Furthermore, saturation index decreased linearly as Paylean dosage increased ($P<0.001$). In pigs fed 4.5 g/ton of Paylean, drip loss percentage decreased (quadratic, $P<0.02$) and loin temperature increased (linear, $P<0.02$) as dietary lysine increased. In control pigs (no Paylean), increasing dietary lysine decreased L* values (linear, $P<0.01$) and b* values and saturation index (quadratic, $P<0.03$), but increased wavelength (linear, $P<0.02$).

For the endpoint pork quality data (d-28, Table 2), increasing Paylean decreased (linear, $P<0.0001$) initial and 5-minute belly firmness. In addition, for pigs fed 4.5 g/ton of Paylean both belly firmness measurements decreased (linear, $P<0.01$ and quadratic, $P<0.04$) as dietary lysine increased. Pigs fed 9.0 g/ton of Paylean had an increase (quadratic, $P<0.04$) in drip loss percentage and

decrease (quadratic, P<0.05) in visual firmness score as dietary lysine increased. In pigs fed Paylean, visual marbling score, decreased (linear P<0.05) as lysine increased.

Chemical Composition. Several trial x treatment interactions were observed for chemical composition (d-14, Table 3) including percentages of loin moisture, belly moisture, belly fat, and belly crude protein. These interactions all have one or more treatments in one trial that did not appear to have the same response as the same treatment in the other trial. However, despite these interactions, the general trends for these responses are the same. In addition, any trial × sex interactions were due to the difference in magnitude in response between genders when comparing the trials.

Increasing Paylean increased (linear P<0.05) loin percentage crude protein and decreased (linear P<0.007) percentage crude fat. In control pigs, increasing dietary lysine increased (linear, P<0.05) loin moisture percentage. In pigs fed 9.0 g/ton of Paylean, loin fat percentage decreased (quadratic, P<0.005) as dietary lysine increased. In pigs fed 4.5 g/ton of Paylean, loin crude protein percentage increased (quadratic, P<0.03) as dietary lysine increased.

In pigs fed 0 and 9.0 g/ton of Paylean, ham fat percentage decreased (linear, P<0.03) as dietary lysine increased. Increasing Paylean increased belly moisture percentage (linear, P<0.03). In control pigs, belly moisture increased (linear, P<0.03) and fat percentage decreased (linear, P<0.05) as dietary lysine increased. Furthermore, pigs fed either 0 or 9.0 g/ton of Paylean had increased (linear, P<0.0008 and P<0.05, respectively) belly crude protein percentage as dietary lysine increased.

Similar to the midpoint composition, there were several interactions observed for loin, ham, and belly composition in pigs slaughtered after 28 days on test (Table 5). These interactions included a trial by treatment interaction for loin moisture percentage and a sex by treatment interaction for loin fat percentage. For the loin moisture percentage interaction, several treatments responded differently between the two trials. Although the treatments responded differently, loin moisture percentages for the two trials were in a narrow range of 73.8 to 74.2%. The loin fat percentage interaction appears to be due to the gilts fed .80% lysine and 4.5 g/ton of Paylean having a higher percentage of loin fat than barrows from that treatment.

As Paylean dosage increased, loin fat and ham ash percentage decreased (linear, P<0.04) and loin crude protein percentage increased (linear, P<0.01). In addition, as Paylean dosage increased, belly moisture, crude protein, and ash percentage increased (linear, P<0.05) and belly fat percentage decreased (linear, P<0.001). For loin composition of pigs fed 4.5 g/ton of Paylean, moisture percentage increased (linear, P<0.05) as dietary lysine increased. In addition, loin fat percentage decreased as lysine increased for pigs fed 0, 4.5 and 9.0 g/ton of Paylean (linear, P<0.05, .006, and .03, respectively). In pigs fed 9.0 g/ton of Paylean, loin crude protein percentage increased (linear, P<0.02) as dietary lysine increased. As Paylean increased, ham fat percentage decreased (linear, P<0.003), and for pigs fed either 0 or 9.0 g/ton of Paylean, increasing dietary lysine decreased (linear, P<0.04) ham fat percentage. In addition, ham crude protein percentage increased (linear, P<0.05) as lysine increased in pigs fed 9.0 g/ton of Paylean. In pigs fed 4.5 g/ton of Paylean, belly moisture percentage and ash percentage increased (linear, P<0.02 and 0.01, respectively), but fat percentage decreased (linear, P<0.02) as lysine increased. At 9.0 g/ton of Paylean, there was an increase in moisture (linear, P<0.007) and crude protein percentage (linear, P< .005) but a decrease in fat percentage (linear, P<0.001) as lysine increased.

Discussion

At the end of the trial, increasing either Paylean or dietary lysine had no effect on drip loss percentage, pH, temperature, loin color or firmness. However, increasing either Paylean or dietary lysine decreased marbling score and belly firmness. Loin composition agreed with the decrease in

marbling score, with pigs fed Paylean having decreased loin fat percentage and increased loin crude protein percentage. The changes in belly firmness appear to be correlated with changes in chemical composition. In pigs fed Paylean, belly fat percentage decreased and belly crude protein percentage increased. In addition, increasing dietary lysine linearly decreased loin, ham, and belly fat percentage in both Paylean and non-Paylean fed pigs. Although both control and Paylean fed pigs responded to increasing dietary lysine, control pigs generally had the greatest improvement as lysine increased from .6 to .8%, whereas Paylean fed pigs appeared to respond to the higher lysine levels of 1.0 to 1.2%.

From previous studies, we know Paylean increases growth performance by increasing lean gain and decreasing fat accretion. This results in a faster gaining, leaner pig. However, loin marbling and belly firmness appear to decrease as fat accretion decreases with the addition of lysine and Paylean. Pigs require higher dietary lysine when fed Paylean, however the higher dietary lysine will cause deterioration in marbling, but will result in a leaner product.

Table 1. Effects of Dietary Lysine and Paylean on Loin and Belly Quality, Day 14[a]

Paylean, g/ton:	0.0				4.5				9.0				
Lysine, %:	0.6	0.8	1.0	1.2	0.8	1.0	1.2	1.4	0.8	1.0	1.2	1.4	SEM
Drip loss, %	3.47	3.99	3.73	2.93	4.14	2.70	3.68	4.72	3.77	3.68	3.42	2.94	0.51
Loin pH	5.54	5.51	5.52	5.54	5.51	5.53	5.51	5.53	5.49	5.53	5.55	5.52	0.02
Loin temp, °C	0.63	0.58	0.64	0.86	0.49	0.72	1.20	1.00	0.78	0.93	0.58	0.86	0.19
Color[b]	3.13	2.09	3.01	3.04	2.90	2.25	2.54	2.68	2.91	2.76	2.72	2.68	0.19
Firmness[c]	2.84	3.08	2.77	3.26	2.77	2.58	2.71	2.54	2.90	2.64	2.71	2.77	0.25
Marbling[d]	1.61	1.55	1.56	1.54	1.68	1.45	1.70	1.17	1.86	1.39	1.51	1.44	0.17
L*	62.1	60.8	59.2	59.5	60.5	58.5	61.1	59.6	59.1	60.6	59.7	10.3	0.72
a*	7.94	7.49	7.76	8.23	7.47	7.79	7.64	7.72	7.32	7.39	7.14	7.35	0.28
b*	16.2	15.7	15.3	16.3	15.2	15.5	15.8	15.4	14.8	15.3	14.9	15.3	0.33
Wavelength	2.33	2.31	2.38	2.45	2.29	2.40	2.31	2.37	2.33	2.29	2.34	2.31	0.04
Hue angle	64.0	64.5	63.1	63.2	63.8	63.3	64.2	63.4	63.8	64.2	64.5	64.3	0.68
Saturation index	18.0	17.4	17.2	18.3	16.9	17.3	17.5	17.2	16.5	17.0	16.5	17.0	0.39
a*:b*	0.49	0.48	0.51	0.51	0.49	0.50	0.48	0.50	0.49	0.48	0.48	0.48	0.01
Initial belly flop, in	6.51	6.02	5.23	6.07	6.24	5.55	6.06	5.01	5.35	5.72	4.33	5.59	0.58
5 min belly flop, in	5.77	5.37	4.65	5.28	5.55	4.99	5.52	4.39	4.77	5.10	3.71	5.07	0.51

[a]A total of 432 pigs with an average initial weight of 175 lb was used in this experiment. Values represent the mean of 12 pens/treatment with one pig/pen.
[b]Scoring system of 1 to 5: 2 = grayish pink; 3 = reddish pink; and 4 = purplish red.
[c]Scoring system of 1 to 5: 2 = soft and exudative; 3 = slightly firm and moist; and 4 = firm and moderately dry.
[d]Scoring system of 1 to 5: 2 = traces to slight; 3 = small to modest; and 4 = moderate to slightly abundant.

Table 1. Continued

	Lysine Linear Contrast P<			Lysine Quadratic Contrast P<			Paylean Response	
	0	4.5	9	0	4.5	9	Linear	Quadratic
Drip loss	0.41	0.23	0.22	0.20	0.02	0.69	0.84	0.30
Loin pH	0.95	0.82	0.30	0.22	0.94	0.10	0.53	0.86
Loin temp[e]	0.37	0.02	0.89	0.48	0.27	0.72	0.44	0.30
Color	0.68	0.66	0.38	0.87	0.03	0.77	0.03	0.01
Firmness	0.40	0.63	0.78	0.63	0.97	0.53	0.22	0.15
Marbling	0.78	0.10	0.13	0.89	0.38	0.25	0.92	0.57
L*	0.01	0.96	0.45	0.28	0.76	0.51	0.37	0.54
a*	0.38	0.64	0.90	0.11	0.68	0.81	0.01	0.66
b*	0.97	0.53	0.47	0.03	0.31	0.90	0.002	0.85
Wavelength	0.02	0.40	0.88	0.22	0.52	0.91	0.09	0.94
Hue angle	0.23	0.91	0.54	0.73	0.87	0.63	0.34	0.51
Saturation index	0.78	0.54	0.60	0.03	0.37	0.98	0.001	0.99
a*:b*	0.22	0.94	0.59	0.74	0.80	0.57	0.37	0.53
Initial belly flop	0.46	0.22	0.80	0.26	0.75	0.45	0.10	0.75
5 min belly flop	0.38	0.19	0.83	0.32	0.57	0.32	0.11	0.63

[E]Sex by trial interaction (P<0.05).

Table 2. Effects of Dietary Lysine and Paylean on Loin and Belly Quality, Day 28[a]

Paylean, g/ton:	0.0				4.5				9.0				
Lysine, %:	0.6	0.8	1.0	1.2	0.8	1.0	1.2	1.4	0.8	1.0	1.2	1.4	SEM
Drip loss, %	4.11	3.28	3.13	3.85	3.16	3.52	4.11	3.57	3.46	4.22	4.00	2.95	0.44
Loin pH	5.53	5.57	5.59	5.59	5.62	5.50	5.60	5.57	5.60	5.75	5.49	5.61	0.07
Loin temp, °C	0.35	0.54	0.44	0.36	0.52	0.32	0.42	0.44	0.32	0.40	0.52	0.34	0.10
Color[b]	2.85	2.83	2.70	2.95	2.87	3.13	2.90	2.77	2.62	2.73	2.68	2.81	0.17
Firmness[c]	3.20	3.14	2.92	3.48	3.00	3.46	2.95	2.76	3.23	2.97	2.64	3.28	0.23
Marbling[d]	1.71	1.63	1.34	1.50	1.58	1.45	1.37	1.13	1.83	1.58	1.29	1.50	0.14
L*	59.8	60.6	59.4	59.4	60.2	61.4	60.3	60.5	60.0	60.3	60.3	60.8	0.92
a*	8.19	7.96	8.15	7.91	7.72	7.84	7.46	7.93	8.19	7.99	8.39	7.97	0.36
b*	16.1	15.9	15.7	15.8	15.4	16.0	15.8	16.4	16.3	15.8	16.4	16.0	0.40
Wavelength	2.41	2.37	2.41	2.41	2.34	2.34	2.32	2.37	2.44	2.39	2.44	2.35	0.06
Hue angle	63.1	63.5	62.6	63.6	63.5	63.9	64.7	64.2	63.6	63.2	62.9	63.5	0.91
Saturation index	18.1	17.8	17.7	17.8	17.3	17.8	17.4	18.3	18.3	17.8	18.5	17.9	0.47
a*:b*	0.51	0.50	0.52	0.50	0.50	0.49	0.47	0.49	0.50	0.51	0.52	0.50	0.02
Initial belly flop, in	9.15	7.96	8.53	8.15	8.59	6.73	5.61	6.61	6.41	7.10	5.81	5.86	0.62
5 min belly flop, in	7.92	7.40	7.71	7.24	7.72	6.06	5.03	5.91	5.63	6.44	5.11	5.11	0.57

[a]A total of 432 pigs with an average initial weight of 175 lb was used in this experiment. Values represent the mean of 12 pens/treatment with one pig/pen.
[b]Scoring system of 1 to 5: 2 = grayish pink; 3 = reddish pink; and 4 = purplish red.
[c]Scoring system of 1 to 5: 2 = soft and exudative; 3 = slightly firm and moist; and 4 = firm and moderately dry.
[d]Scoring system of 1 to 5: 2 = traces to slight; 3 = small to modest; and 4 = moderate to slightly abundant.

Table 2. Continued

	Lysine Linear Contrast P<			Lysine Quadratic Contrast P<			Paylean Response	
	0	4.5	9	0	4.5	9	Linear	Quadratic
Drip loss	0.63	0.35	0.37	0.08	0.32	0.04	0.86	0.90
Loin pH	0.50	0.85	0.48	0.78	0.53	0.84	0.47	0.68
Loin temp[e]	0.89	0.76	0.67	0.14	0.24	0.18	0.72	0.80
Color	0.83	0.49	0.50	0.42	0.28	0.95	0.39	0.17
Firmness	0.54	0.23	0.86	0.18	0.17	0.05	0.42	0.65
Marbling	0.15	0.03	0.05	0.38	0.68	0.11	0.96	0.07
L*	0.54	0.95	0.55	0.65	0.59	0.93	0.51	0.33
a*	0.68	0.88	0.87	0.99	0.64	0.76	0.77	0.11
b*	0.58	0.12	0.76	0.68	0.91	0.90	0.45	0.63
Wavelength	0.88	0.75	0.34	0.76	0.63	0.76	0.89	0.10
Hue angle	0.88	0.50	0.97	0.75	0.61	0.55	0.87	0.15
Saturation index	0.58	0.20	0.73	0.72	0.79	0.99	0.48	0.32
a*:b*	0.91	0.49	0.97	0.84	0.60	0.56	0.83	0.12
Initial belly flop	0.37	0.01	0.29	0.51	0.03	0.61	0.0001	0.02
5 min belly flop	0.48	0.01	0.24	0.96	0.04	0.47	0.0001	0.26

[e]Sex by trial interaction (P<0.05).

Table 3. Effects of Dietary Lysine and Paylean on Chemical Composition of the Loin, Ham and Belly, Day 14[a]

Paylean, g/ton:	0.0				4.5				9.0				
Lysine, %:	0.6	0.8	1.0	1.2	0.8	1.0	1.2	1.4	0.8	1.0	1.2	1.4	SEM
Loin, %[b]													
Moisture	74.1	74.4	75.1	74.6	74.3	74.0	74.3	74.7	74.1	74.4	74.7	74.4	0.24
Fat	1.98	1.85	1.57	1.68	2.21	2.38	1.42	1.44	2.53	1.94	1.55	1.80	0.21
Crude protein	21.5	21.4	21.3	21.6	21.1	22.0	22.4	21.9	21.3	21.0	22.0	22.3	0.32
Ash	1.55	1.57	1.58	1.64	1.50	1.55	1.56	1.42	1.47	1.57	1.53	1.42	0.07
Ham, %[c]													
Moisture	75.0	74.8	74.9	74.9	75.0	74.8	74.7	74.8	74.9	75.0	75.2	74.7	0.20
Fat	1.25	1.03	0.88	0.96	1.07	1.05	0.94	1.10	1.27	1.18	0.85	0.05	0.10
Crude protein	21.8	22.2	22.0	22.1	21.7	22.5	22.2	22.4	21.8	21.7	22.3	22.3	0.28
Ash	1.76	1.78	1.75	1.74	1.73	1.71	1.81	1.78	1.84	1.78	1.67	1.67	0.07
Belly, %[d]													
Moisture	48.9	50.2	52.7	52.7	52.0	51.3	54.6	53.3	51.8	52.3	54.2	53.3	1.12
Fat	35.7	33.6	30.0	29.8	31.8	31.7	27.8	29.6	32.0	30.9	28.3	29.7	1.52
Crude protein	13.9	14.7	15.7	16.0	15.1	15.7	16.5	15.7	15.0	15.5	15.9	16.2	0.43
Ash	0.67	0.73	0.76	0.75	0.79	0.78	0.81	0.79	0.74	0.78	0.78	0.81	0.04

[a]A total of 432 pigs with an average initial weight of 175 lb was used in this experiment. Values represent the mean of 12 pens/treatment with one pig/pen.
[b]The loin sample taken was from the lean tissue of the 9th chop.
[c]The ham sample taken was from the lean tissue of the biceps femoris.
[d]The belly sample was a center slice (skin, fat, and lean) from the belly.

Table 3. Continued

	Lysine Linear Contrast P<			Lysine Quadratic Contrast P<			Paylean Response	
	0	4.5	9	0	4.5	9	Linear	Quadratic
Loin								
Moisture[e]	0.05	0.21	0.24	0.13	0.13	0.31	0.34	0.21
Fat[f]	0.25	0.001	0.007	0.58	0.73	0.05	0.23	0.99
Crude protein	0.88	0.05	0.006	0.63	0.03	0.26	0.33	0.12
Ash	0.43	0.43	0.53	0.83	0.18	0.14	0.10	0.47
Ham								
Moisture	0.85	0.40	0.73	0.57	0.48	0.13	0.72	0.41
Fat[f]	0.03	0.98	0.001	0.12	0.40	0.77	0.83	0.99
Crude protein	0.45	0.10	0.10	0.60	0.24	0.85	0.92	0.30
Ash	0.75	0.44	0.11	0.77	0.94	0.53	0.66	0.72
Belly								
Moisture[e]	0.01	0.16	0.19	0.57	0.77	0.53	0.03	0.25
Fat[f]	0.005	0.13	0.17	0.56	0.52	0.44	0.07	0.29
Crude protein[f]	0.0008	0.17	0.05	0.59	0.10	0.90	0.08	0.16
Ash	0.13	0.97	0.18	0.35	0.94	0.85	0.07	0.10

[e]Trial by treatment interaction (P<0.05).
[f]Sex by trial interaction (P<0.05).

Table 4. Effects of Dietary Lysine and Paylean on Chemical Composition of the Loin, Ham and Belly, Day 28[a]

Paylean, g/ton:	0.0				4.5				9.0				
Lysine, %:	0.6	0.8	1.0	1.2	0.8	1.0	1.2	1.4	0.8	1.0	1.2	1.4	SEM
Loin, %[b]													
Moisture	73.8	73.8	74.0	73.8	73.8	74.1	74.3	74.4	73.8	74.0	74.2	74.2	0.22
Fat	2.49	2.04	1.78	1.96	2.23	1.78	1.43	1.51	2.25	1.65	1.50	1.66	0.20
Crude protein	21.4	21.9	22.0	22.1	2.18	22.1	22.6	22.0	21.7	22.4	22.5	22.7	0.27
Ash	1.59	1.60	1.54	1.47	1.44	1.45	1.47	1.45	1.47	1.55	1.41	1.48	0.06
Ham, %[c]													
Moisture	74.5	74.3	74.6	74.4	74.7	74.6	74.8	74.8	74.5	74.6	74.8	74.8	0.19
Fat	1.36	1.22	0.94	0.96	0.06	1.11	0.84	0.83	1.20	0.78	0.87	0.85	0.10
Crude protein	22.0	22.4	22.1	22.4	22.4	22.4	22.5	22.1	22.1	22.5	22.7	22.9	0.28
Ash	1.77	1.75	1.76	1.69	1.69	1.58	1.71	1.67	1.66	1.69	1.59	1.64	0.06
Belly, %[d]													
Moisture	48.2	49.2	48.8	49.5	49.5	49.0	51.7	52.2	50.3	50.4	52.4	53.8	1.01
Fat	36.1	34.3	35.6	34.4	34.7	35.4	31.6	30.9	33.8	33.6	30.4	28.8	1.40
Crude protein	14.4	15.1	14.3	14.7	15.3	14.9	15.6	15.6	14.8	15.0	16.3	16.2	0.39
Ash	0.65	0.71	0.69	0.73	0.71	0.70	0.74	0.81	0.72	0.76	0.73	0.77	0.03

[a]A total of 432 pigs with an average initial weight of 175 lb was used in this experiment. Values represent the mean of 12 pens/treatment with one pig/pen.
[b]The loin sample taken was from the lean tissue of the 9th chop.
[c]The ham sample taken was from the lean tissue of the biceps femoris.
[d]The belly sample was a center slice (skin, fat, and lean) from the belly.

Table 4. Continued

	Lysine Linear Contrast P<			Lysine Quadratic Contrast P<			Paylean Response	
	0	4.5	9	0	4.5	9	Linear	Quadratic
Loin								
Moisture[e]	0.70	0.05	0.19	0.66	0.62	0.66	0.28	0.10
Fat[f]	0.05	0.006	0.03	0.12	0.19	0.06	0.04	0.15
Crude protein	0.10	0.37	0.02	0.43	0.09	0.32	0.01	0.64
Ash	0.10	0.76	0.68	0.44	0.78	0.93	0.07	0.06
Ham								
Moisture	0.98	0.69	0.23	0.89	0.76	0.94	0.12	0.14
Fat[f]	0.003	0.16	0.04	0.47	0.46	0.06	0.01	0.19
Crude protein	0.46	0.47	0.05	0.89	0.47	0.76	0.12	0.77
Ash	0.44	0.81	0.57	0.66	0.56	0.92	0.03	0.45
Belly								
Moisture[e]	0.46	0.02	0.007	0.90	0.63	0.50	0.0002	0.63
Fat[f]	0.57	0.02	0.005	0.85	0.62	0.60	0.001	0.78
Crude protein[f]	0.90	0.33	0.001	0.81	0.63	0.61	0.001	0.27
Ash	0.11	0.01	0.40	0.72	0.22	0.97	0.05	0.29

[e]Trial by treatment interaction (P<0.05).
[f]Sex by trial interaction (P<0.05).