

THE EFFECT OF SUPPLEMENTING PAYLEAN AND LIPOIC ACID TO A COMPLETE SWINE FINISHING DIET FOR THE LAST 31 DAYS OF PRODUCTION ON PORK LONGISSIMUS SHELF LIFE

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Introduction

Paylean is the commercial name of ractopamine hydrochloride; an orally active growth promotant that effectively shuttles energy away from fat deposition to muscle accretion. Currently, Paylean is approved (United States Food and Drug Administration) for supplementation between 41 to 109 kg of body weight. Past research has indicated that Paylean has limited impact on pork quality (Apple et al., 2004).

Lipoic acid is a naturally occurring compound that is found in all body tissues, with muscle having the highest concentrations (Rentfrow et al., 2004). This antioxidant has been described as universal due to its ability to be both fat and water soluble. In addition, lipoic acid has the ability to regenerate fat soluble vitamins (E and C) which scavenge the free radicals that cause lipid oxidation.

Color is the main quality parameter that consumers use to gauge desirability when buying pork. Vitamin E is an antioxidant that has been shown to increase the shelf life of beef and pork when supplemented to normal finishing diets. It is conceivable that lipoic acid supplementation could accomplish this goal as well. There is limited research regarding Paylean fed with or without an antioxidant on the shelf life of pork.

Objectives

The objectives of this research were to characterize the affect of Paylean and lipoic acid supplemented to a complete swine finishing diet on pork Longissimus shelf life.

Materials and Methods

Twenty-four crossbred barrows (Hampshire x Yorkshire) were ultrasounded, weighed, and blocked into treatments (n = 6/ treatment) stratifying to percent muscle. The pigs were given ab libitum access to water and a corn-soybean meal diet that contained 1.2% total lysine. The animals were penned (14.9 m²) according to treatment with three feeders and two nipple waters per pen. The lysine level was increased to achieve the full benefits of Paylean to maximize muscle growth. The treatment delivery system used 40 g of nursery pig diet that was moistened with water into a dough then supplemented with either 18 mg of Paylean (PAY), 300 mg of lipoic acid (LA), or a combination of both (COMBO). Control pigs received only dough balls. The dough balls were hand fed twice

daily (0800 and 1800h) for 31 d. Prior to treatments, pigs were given 14 d to acclimate to the basal diet and trained to eat dough balls.

Pigs were harvested according to humane harvesting practices at the University of Missouri abattoir on d 32. Following a 24 h chill (4° C), the left Longissimus muscle was removed and one, 2.54 cm chop was removed posterior of the 10th/11th rib interface, placed on a styrofoam tray and over wrapped with a oxygen permeable polyvinyl chloride film (PVC). Chops were placed in a retail display case (2° C) with constant cool white fluorescent lighting (1300 lux). Daily objective color measurements (L*, a*, and b* values) were recorded for 8 d using a Hunter Lab Miniscan XE Plus colorimeter (D65/10°) calibrated to a black and white tile over wrapped with PVC to allow calibration to account for retail tray over wrap. The calibration technique allowed for color data to be recorded without removing the over wrap. A small mark was made on each package to ensure that objective color measurements were taken from the same location each day. Hue angle ($\arctan(b^*/a^*) \times 57.3$) and chroma ($\sqrt{a^{*2} + b^{*2}}$) was calculated from daily a* and b* values.

The Mixed model procedure of SAS (SAS Inst. Inc, Cary, NC) was used to used to analyze the affects of objective color measurement x days of retail display. When the F-test was significant (P < 0.05), treatment means were separated by a Bonferonni adjustment.

Results and Discussion

Paylean, LA, and COMBO had no effect (P = 0.09) on the L* values (lightness) during the eight days of retail display (Table 1). Past research has indicated that Paylean and lipoic acid have no affect on L* values (Berg et al., 2003; Apple et al., 2004).

Table 1. The L* values (lightness) for days of retail display x treatment.

Treatment	0	1	2	3	4	5	6	7	SEM
CON	50.98	52.37	52.17	51.74	51.87	52.09	52.37	52.54	1.333
PAY	51.12	53.37	52.55	52.30	52.61	51.97	53.08	53.45	1.333
LA	51.49	53.72	52.89	52.62	53.14	53.03	53.42	53.56	1.333
COMBO	54.11	56.27	55.36	55.05	55.55	55.71	56.22	57.30	1.333

CON = control; PAY = paylean; LA = lipoic acid; COMBO = paylean + lipoic acid.
The L* value is an indication of lightness; 100 = white; 0 = black.

Although differences (P > 0.0001) were presented on d 0, 1, and 4 for b* values (yellowness), no consistent trend was observed throughout retail display (Table 2).

Table 2. The b* values (yellowness) for days of retail display x treatment.

Treatment	0	1	2	3	4	5	6	7	SEM
CON	14.93 ^d	17.76 ^a	18.31 ^a	18.43 ^a	18.10 ^a	17.52 ^b	17.42 ^b	17.37 ^b	0.332
PAY	14.25 ^e	16.47 ^c	18.08 ^a	18.01 ^a	17.67 ^a	17.23 ^b	17.08 ^b	16.90 ^b	0.332
LA	14.62 ^d	16.51 ^c	17.90 ^a	17.82 ^a	17.39 ^b	17.05 ^b	16.94 ^b	16.88 ^b	0.332
COMBO	15.30 ^d	16.67 ^b	17.92 ^a	17.85 ^a	17.35 ^b	17.03 ^b	17.07 ^b	16.91 ^b	0.332

^{a, b, c, d, e}. Means in a column that do not have common superscripts differ by $P < 0.05$.
 CON = control; PAY = paylean; LA = lipoic acid; COMBO = paylean + lipoic acid.
 The b* value is a measure of yellowness (higher value, more yellow).

After 2 and 4 days of retail display the COMBO and PAY had lower a* values ($P < 0.0001$; Table 3) and higher hue angle values ($P < 0.0001$; Table 4), respectively. Past research has shown that Paylean supplementation lowers a* and b* values (Apple et al., 2004). This is in agreement with the current research. The hue angle is a calculation of true red, where 0 equals true red. Although there is limited research on the affects of Paylean on hue angle, it is conceivable that lower a* and b* values would produce higher hue angle values. Berg et al. (2003) showed that lipoic acid supplementation has no affect on a* and b* values.

Table 3. The a* values (redness) for days of retail display x treatment.

Treatment	0	1	2	3	4	5	6	7	SEM
CON	9.170 ^b	12.48 ^a	12.28 ^a	11.92 ^a	10.91 ^a	9.810 ^b	9.450 ^b	8.770 ^b	0.798
PAY	7.870 ^c	11.32 ^a	11.66 ^a	10.98 ^a	9.940 ^b	9.070 ^b	8.640 ^b	7.850 ^c	0.798
LA	8.690 ^b	11.47 ^a	12.14 ^a	11.63 ^a	10.61 ^a	9.920 ^b	9.500 ^b	8.870 ^b	0.798
COMBO	10.14 ^b	10.58 ^a	10.33 ^b	9.630 ^b	8.310 ^b	7.290 ^c	5.710 ^c	5.920 ^c	0.798

^{a, b, c, d, e}. Means in a column that do not have common superscripts differ by $P < 0.05$.
 CON = control; PAY = paylean; LA = lipoic acid; COMBO = paylean + lipoic acid
 The a* value is a measure of redness (higher value, more red).

Table 4. The hue angle (true red) calculation for days of retail display x treatment.

Treatment	0	1	2	3	4	5	6	7	SEM
CON	58.36 ^c	54.97 ^c	56.24 ^c	57.29 ^c	59.13 ^c	60.98 ^b	61.72 ^b	63.40 ^b	1.997
PAY	61.10 ^b	55.53 ^c	57.22 ^c	58.66 ^c	60.68 ^b	62.26 ^b	63.17 ^b	65.05 ^a	1.997
LA	59.38 ^b	55.23 ^c	55.96 ^c	57.02 ^c	58.76 ^c	59.99 ^b	60.94 ^b	62.44 ^b	1.997
COMBO	57.49 ^c	57.74 ^c	60.44 ^b	62.09 ^b	64.87 ^a	67.29 ^a	67.80 ^a	71.04 ^a	1.997

^{a, b, c, d, e}. Means in a column that do not have common superscripts differ by $P < 0.05$.
 CON = control; PAY = paylean; LA = lipoic acid; COMBO = paylean + lipoic acid.
 The hue angle calculation is a measure of true red (the lower the value, the closer to true red).

Chroma is a measurement of how vivid or saturated a color appears, with a higher value indicating a more saturated color. After 5 days of retail display, the COMBO treatment had lower chroma values ($P < 0.0001$) and at day 7 the COMBO and PAY had lower values ($P < 0.0001$) than CON and LA. Apple et al. (2004) indicated that Paylean had no affect on chroma calculations. There is limited research on the effect of lipoic acid supplementation on the pork Longissimus. Rentfrow et al. (2004) showed that lipoic acid supplemented to a beef finishing ration has no affect on chroma calculations

Table 4. The chroma (color vividness) calculations for days of retail display x treatment.

Treatment	0	1	2	3	4	5	6	7	SEM
CON	17.53 ^d	21.72 ^a	22.09 ^a	22.01 ^a	21.22 ^a	20.18 ^b	19.93 ^b	19.59 ^b	0.535
PAY	16.29 ^e	19.99 ^b	21.52 ^a	21.10 ^a	20.28 ^b	19.49 ^b	19.16 ^b	18.65 ^c	0.535
LA	17.03 ^d	20.10 ^b	21.65 ^a	21.30 ^a	20.41 ^b	19.77 ^b	19.47 ^b	19.12 ^b	0.535
COMBO	18.59 ^c	19.78 ^b	20.77 ^a	20.39 ^b	19.36 ^b	18.66 ^c	18.63 ^c	18.06 ^c	0.535

^{a, b, c, d, e.} Means in a column that do not have common superscripts differ by $P < 0.05$.

CON = control; PAY = paylean; LA = lipoic acid; COMBO = paylean + lipoic acid.

The chroma calculation is a measure of how vivid a color appears (higher the value, the more vivid appearance).

Conclusion

These data indicate that the supplementation of Paylean fed with or without the antioxidant lipoic acid produced less desirable a*, hue angle, and chroma values after 7 days of retail display.

Literature Cited

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