# The effect of alpha lipoic acid on shelf life and Warner/Bratzler shear force values associated with fresh pork.

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Alpha-Lipoic acid (**ALA**) is a naturally occurring compound present in all tissues of the body. It is naturally found in leaves of plants that contain mitochondria and in non-photosynthetic plant tissues such as roots and tubers; however, red meat possesses the highest concentration of naturally occurring LA. Lipoic acid has gained popularity as a human dietary supplement due to its unique antioxidant capabilities, ability to improve the function of insulin (enhanced glucose clearance), and its ability to improve mitochondrial energy metabolism.

The objective of this trial was to determine the affects of supplementation of the unique antioxidant alpha lipoic acid to finishing swine from 95 to 117 kg BW on the shelf stability and palatability of fresh pork. Fifty-four commercial hybrid pigs were randomly allotted to three treatments; a control (Control) group compared to supplemental ALA at 8 (**ALA8**) or 16 mg per kg (**ALA16**) of final market weight (117 kg). Upon reaching 117 kg BW, pigs were delivered in two groups to a commercial abattoir that utilizes $CO_2$ stunning. All pigs were humanely harvested; carcasses were blast chilled then chilled for 20 h at 4$^oC$. Hams and loins were collected on-line, wrapped, boxed, and delivered the same day to the University of Missouri Meats laboratory. Upon arrival, the Semimembranosus (**SM**) was sliced in the center perpendicular to the muscle fibers, and a 2.54 cm steak removed. Longissimus muscle (**LM**) chops were removed anterior to the tenth rib, placed in Styrofoam retail trays, over-wrapped with oxygen-permeable PVC film, and placed in a simulated retail display case for 7 d retail evaluation. Loin chops and SM steaks were evaluated on day 0, 1, 4, and 7 for CIE L*, a*, and b*-values and pH. Chops were also subjectively evaluated for color (NPPC, 2000), firmness (1 = soft; 5 = very firm), marbling (NPPC, 2000), and odor (1 = normal fresh pork; 3.5 = threshold for unacceptable; and 5 = rancid). Two chops were weighed, vacuum packaged and aged for 20 or 40 d at 1$^oC$. After storage, chops were removed from packaging weighed, and placed for evaluation in a 7 d simulated retail shelf display as described above. Additional LM chops were evaluated for Warner/Bratzler shear force at 1, 20, and 40 d postmortem. Least squared means for carcass characteristics and primal cut out data are reported in Table 1. Carcass weights from ALA 16 were lower ($P < 0.05$) than Control; in addition dressing percent of ALA 16 was lower ($P < 0.05$) than the Control. No differences ($P > 0.05$) were seen across treatment for percentage carcass lean, belly weight, last rib pH (22 h postmortem), fifth rib pH (22 h postmortem), percent drip loss, loin color, loin firmness, and loin marbling score. Control hams and loins were heavier than ALA16. No significant differences were observed in ham and loin expressed as a percentage of carcass weight. Boneless loins from ALA16 were lighter ($P < 0.05$) than Controls, however, no differences (P > 0.05) were seen across treatment for percentage boneless loin yield. Similar to ham and loins, belly weight for ALA16 was lower than Control with no difference in percent belly yield. Least squared means for L*, a*, b*, pH, color, firmness, and odor are reported in Table 2. Warner-Bratzler shear force values, marbling scores, and odor scores showed no difference across the three treatments during the three aging periods. Semimembranosus steaks from ALA16 had significantly lower subjective color scores than controls (3.94 vs. 3.45) and ALA8 loin chops were darker than ALA16 chops upon removal from 40 d vacuum packaged storage (3.40 vs. 2.93), however neither ALA treatment differed from controls (3.17; P > 0.05). Firmness scores for Control and ALA8 were higher (P < 0.05) than scores for ALA16. While there was no difference (P > 0.05) in pH for SM and LM chops aged 0 d, there were differences (P < 0.05) between Control and ALA16 at 20 d post mortem (5.66 vs. 5.59, respectively). For chops aged 0, 20, and 40 d, there were no differences in a* or b* across the three treatments. There were differences in L* (P < 0.05) for loin chops aged 0 d, with ALA16 being lighter than ALA8 (56.1 vs. 54.3, respectively).

**Table 1**. Least squared means for carcass characteristics and primal cut out values for pork carcass fed varying levels of alpha lipolic acid.

| | Control | ALA 8 | ALA 16 |
|---|---|---|---|
| Hot carcass wt (kg) | 91.0[a] | 85.0[ab] | 83.4[b] |
| Dressing percent (%) | 73.0[a] | 70.0[ab] | 72.0[b] |
| Percentage carcass lean (%) | 53.9 | 55.2 | 54.1 |
| Belly wt (kg) | 22.3 | 20.7 | 21.7 |
| Last Rib pH (22 h) | 5.5 | 5.5 | 5.5 |
| Fifth rib pH (22 h) | 5.5 | 5.5 | 5.5 |
| Percent drip loss | 6.0 | 5.0 | 6.0 |
| Loin subjective color | 2.61 | 2.61[a] | 2.55 |
| Loin subjective firmness | 1.94 | 2.07[a] | 1.88 |
| Loin subjective marbling | 2.61 | 2.46[a] | 2.61 |
| Ham wt (kg) | 21.1[a] | 20.0[ab] | 19.7[b] |
| Percentage ham (%) | 23.0[a] | 23.0 | 23.0 |
| Loin wt (kg) | 21.2[a] | 19.8[ab] | 19.4[a] |
| Percentage loin (%) | 23.0 | 23.0 | 23.0 |
| Total bnls loin wt (kg) | 7.1[a] | 6.8[ab] | 6.3[a] |
| Percentage boneless loin (%) | 33.0 | 34.0 | 32.0 |
| Belly wt (kg) | 13.6 | 12.7 | 12.4 |
| Percentage belly (%) | 14.9 | 14.9 | 14.7 |

[a, b,] Means within a each row with common superscripts do not differ ($P < 0.05$).

**Table 2**. Least squared means for L*, a*, b*, and pH for the Semimembranousus muscle (0 d), and the Longissimus (0, 20, and 40 d) for pork carcasses fed alpha lipolic acid.

| | L* | a* | b* | pH | Color | Firm | Odor |
|---|---|---|---|---|---|---|---|
| SM 0 d | | | | | | | |
| Control | 48.5 | 10.9 | 16.9 | 5.66 | 3.94[a] | 2.52[a] | 1.15[a] |
| ALA 8 | 48.9 | 11.1 | 17.3 | 5.62 | 3.85[ab] | 3.85[a] | 1.29[a] |
| ALA 16 | 50.3 | 10.7 | 17.2 | 5.61 | 3.45[b] | 3.45[b] | 1.31[a] |
| Loin 0 d | | | | | | | |
| Control | 55.6[ab] | 8.8 | 16.3 | 5.59 | 3.12 | 2.73[a] | 1.22 |
| ALA 8 | 54.3[a] | 9.0 | 16.1 | 5.58 | 3.39 | 2.52[b] | 1.14 |
| ALA 16 | 56.1[b] | 8.7 | 16.1 | 5.57 | 3.08 | 2.57[ab] | 1.14 |
| Loin 20 d | | | | | | | |
| Control | 52.9 | 8.5 | 16.8 | 5.66[a] | 2.91 | 2.91 | 2.05[a] |
| ALA 8 | 52.7 | 8.6 | 16.9 | 5.61[ab] | 3.00 | 2.87 | 1.77[b] |
| ALA 16 | 54.4 | 8.3 | 16.9 | 5.59[b] | 2.75 | 2.94 | 1.92[ab] |
| Loin 40 d | | | | | | | |
| Control | 53.0 | 8.0 | 17.4 | 5.59 | 3.17[ab] | 3.23 | 2.34 |
| ALA 8 | 52.5 | 8.4 | 17.8 | 5. 56 | 3.40[a] | 3.14 | 2.37 |
| ALA 16 | 54.0 | 8.0 | 17.6 | 5.52 | 2.93[b] | 3.17 | 2.23 |

[a, b]Means within a each column and group with common superscripts do not differ ($P < 0.05$).

Biographical Sketch of Eric Berg, Ph.D.

Eric Berg was born and raised south of Fargo, ND. He obtained B.S. degrees in Animal & Range Science and Agricultural Education in 1989 and an M.S. degree in Meat Science in 1991 from North Dakota State University. Eric received his Ph. D. in Meat Science and Muscle Biology from Purdue University in 1996 and then worked for 18 months as a postdoctoral research associate at Texas A&M University. He then joined the faculty of the Animal Science department at the University of Missouri as an Assistant Professor of Meat Science. His area of research has evaluated the influence of diet on the ultimate eating quality of meat-producing animals and is author of the chapter regarding "Swine Nutrition, the Conversion of Muscle to Meat, and Pork Quality" in the 2nd edition of *Swine Nutrition*. Additionally, Eric was the author of the Pork Fact sheet entitled *Critical points affecting fresh pork quality within the packing plant*, which is widely used in the pork industry as a reference for optimal handling and processing of swine at the meat packing plant. Eric is an active member of the American Association of Animal Science and the American Meat Science Association. He is a member of the 2002 ASAS Meat Science and Muscle Biology Program Committee and currently serves on the National Pork Boards Quality Solutions Team.

**BIOGRAPHY – Dr. Elisabeth Huff-Lonergan**

Elisabeth Huff-Lonergan received her B.S. degree in Food Science from University of Missouri/Columbia in 1988. She received her Master of Science in 1991 and her Ph.D. degree in 1995 from Iowa State University with a double major in Meat Science and Muscle Biology. Immediately following graduation in 1995, Elisabeth became an Assistant Professor in the Animal and Dairy Science Department at Auburn University in Auburn, Alabama. While at Auburn, she focused her research on identification of factors in porcine muscle that influence water-holding capacity and tenderness. Elisabeth joined the Department of Animal Science, Iowa State University, in the fall of 1998 as an Assistant Professor. She has continued at ISU to focus her research on the fundamental mechanisms underlying the development of fresh meat quality attributes.

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