Graduate Student Research Poster Competition

Ph.D. DIVISION

Survival of *Escherichia coli* O157:H7 on Vacuum-Packaged Raw Beef Treated With Polylactic Acid, Lactic Acid, and Nisin

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This study investigated efficacy of low molecular weight-polylactic acid (LMW-PLA), lactic acid (LA), Nisaplin™, and combination of Nisaplin™ and each acid on reducing populations of *E. coli* O157:H7 on fresh raw beef. Fresh beef cubes were inoculated in a cell suspension containing 10^6 - 10^7 CFU/mL of *E. coli* O157:H7 for 5 min and drip-dried for 15 min. Inoculated beef cubes were immersed in a solution of 2% LMW-PLA, 2% LA, 400 IU Nisaplin™/mL or combinations of each acid and Nisaplin™ for 5 min, drip-dried, vacuum-packaged, and stored at 4°C for up to 28 days. Surface pH values and numbers of *E. coli* O157:H7 were determined weekly. Solutions of 2% LMW-PLA, 2% LA, 400 IU Nisaplin™/mL and combinations of Nisaplin™ in either 2% LMW-PLA (2% NPLA) or 2% LA (2% NLA) significantly reduced surface pH values of beef cubes from 5.67 to 5.02, 4.90, 5.45, 4.97 and 4.91, respectively at day 0 ($P = 0.05$). In general, the acid treatments significantly lowered the surface pH values of beef cubes compared to the untreated controls up to 28 days. The 2% LMW-PLA, 2% LA, 2% NPLA, and 2% NLA reduced populations of *E. coli* O157:H7 by 0.89, 0.95, 0.80, and 1.07 $\log_{10}$ reduction, respectively, compared to the initial number of 5.20 $\log_{10}$ CFU/cm^2 of the untreated control ($P = 0.05$). Numbers of *E. coli* O157:H7 on these samples slowly decreased during storage and at day 28, the counts significantly reduced to 3.13, 2.99, 2,91, and 2.83 log $\log_{10}$ CFU/cm^2, respectively ($P = 0.05$) while the untreated control contained 4.47 $\log_{10}$ CFU/cm2. These findings suggested that efficacy of 2% LMW-PLA, 2% LA, 2% NPLA and 2% NLA on *E. coli* O157:H7 reductions was not significantly different. The 400 IU Nisaplin™/mL had neither antimicrobial property against *E. coli* O157:H7 nor efficacy at enhancing 2% LMW-PLA or 2% LA . The combination of vacuum-packaging and refrigeration temperature showed little effect on inhibiting growth of *E. coli* O157:H7 during storage.

Color and TBARS of Irradiated Pork Patties from Pigs fed CLA Supplemented Diets

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Irradiation of pork is an effective means of controlling foodborne pathogens and extending shelf life. However, irradiation results in color changes and increased lipid oxidation. Pigs fed diets supplemented with conjugated linoleic acid may produce pork that is less likely to oxidize. The objective of this study was to determine the effects of CLA and irradiation on the color of refrigerated pork patties and on the oxidative stability of frozen pork patties. Pigs were fed a control diet (no CLA) or a diet containing 0.75% CLA. Unpackaged ground pork patties were irradiated by electron beam to 0 kGy or 3.5 kGy. Refrigerated patty color was measured for two weeks using a Hunter Labscan. For determination of oxidative stability, frozen patties were subjected to TBARS analysis for six months. Hunter L values decreased with CLA supplementation and irradiation but increased with storage time. Hunter a values increased with CLA supplementation and irradiation, but decreased with storage time. TBARS increased with irradiation. Irradiated samples from CLA supplemented pigs exhibited lower TBARS than irradiated control samples. TBARS increased with storage time, especially between days 120 and 180. Both CLA supplementation and irradiation worked to combat the increase in lightness and decrease in redness of pork patties during refrigerated storage. CLA offered oxidative protection for frozen irradiated patties.

Characterization of Callipyge Muscle Growth and Meat Quality Using a Muscle Cell Culture System

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Eighteen callipyge and eighteen normal Rambouillet cross sheep were processed at the Texas Tech University Meat Lab. Carcass traits were measured and samples for calpastatin and myofibrillar fragmentation index (MFI) were taken after 24 h postmortem. Serum (5% v/v) or muscle extract (400 µg/mL) was added to a primary bovine myoblast culture to determine amino acid uptake and protein degradation using ^{14}C-labeled amino acids. After aging for 14 d, longissimus muscle was evaluated for MFI, Warner-Bratzler shear (WBS), and

trained sensory panel evaluations. Longissimus areas, calpastatin activity, and WBS values were higher and MFI and trained sensory panel scores were lower for callipyge compared to normal sheep ($P < .05$). Serum from callipyge sheep did not affect ($P > .05$) protein synthesis or protein degradation in the cell culture system. Muscle extract added to the culture media decreased ($P < .05$) protein degradation by 31%, but did not affect ($P = .07$) protein synthesis. Cellular protein degradation, marbling, 1 d MFI, and 14 d MFI accounted for 25%, 54%, 77%, 71% of the variation in WBS, respectively ($P < .05$). Initial and sustained tenderness could be explained ($P < .05$) by cellular protein degradation ($R^2 = .33$ and .31), marbling ($R^2 = .51$ and .50), 1 d MFI ($R^2 = .81$ and .78), and 14 d MFI ($R^2 = .65$ and .65). These data indicate that the increase in muscle mass and decrease in meat tenderness in callipyge sheep is caused primarily by a decrease in muscle protein degradation.

Effects Of Supranutritional Oral Supplementation With Vitamin D_3 And Calcium To Improve Beef Tenderness

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Intrinsic, calcium dependent proteases deteriorate the ultrastructure of muscle during the early postmortem period. Due to the calcium dependent nature of these proteases, it has been hypothesized that oral supplementation with vitamin D_3 will increase both muscle Ca^{++} content and activity of these muscle proteases. Individual heifers (n = 191) were supplemented via oral bolus with one of 8 levels of vitamin D_3 (0,1,2,3,4 and 5 million IU/d and 2 million IU/d plus 75 g Ca^{++} and 4 million IU/d plus 75 g Ca^{++}) for 2, 4, 6 or 8 days antemortem. Feedlot performance and carcass data were collected and Warner-Bratzler Shear (WBS) force was measured at 2, 7, 14 and 21 days postmortem for *longissimus lumborum* steaks cooked to 70° and 85°C. Supplementation with vitamin D_3 generally decreased daily feed intake (as-fed), and reduced average daily gains, compared with controls during the 8 d supplementation period. Additionally, supplemented cattle had higher dressing percentages, indicating less fill at the time of slaughter. Supplementation with vitamin D_3 did not affect ($P > .05$) WBS force at 2, 7, 14, or 21 d of postmortem aging compared with controls at either 70° or 85°C. Therefore, these results indicate that oral supplementation with vitamin D_3 (at high or low doses) for 2 to 8 d before slaughter does not improve beef tenderness.