Graduate Student Research Poster Competition

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Microbiology of Hot-Boned Beef

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Compared with conventional processing, hot-boning of beef has many potential advantages which include savings of energy input, reducing shipment costs, reducing cooler space, and facilitating centralized processing. Since the beef is fabricated while still "hot" (ca. 35C) the chances of microbial proliferation in hot-boned beef are higher than beef processed by the conventional procedure (fabrication of beef after chilling for 48 h). In order to ensure a safe product the number and kinds of microorganisms in hot-boned beef during processing and after storage must be ascertained. Using miniaturized microbiological techniques and computer assisted identification procedures, 672 bacterial isolates obtained from hot-boned beef and conventionally processed beef at the time of processing as well as after 14 days storage at 2C under vacuum packaging were analyzed. The results indicated that hot-boned beef harbored more proteolytic and fluorescent bacteria than conventionally processed beef at the time of fabrication as well as after cold storage. Both hot-boned and conventionally processed beef harbored lipolytic bacteria at the time of fabrication (ca. 30-40%), after 24 days cold storage the number reduced to ca. 10% of total. We have determined that hot-boned beef harbored more bacteria and a greater variety of bacteria at the time of fabrication which subsequently affected the shelf life of the beef compared with conventionally processed beef. Proper initial chilling of hot-boned meat will enhance the quality of beef.

Beef Carcass Electrical Stimulation and Hot Boning Effects on Psoas Major and Triceps Brachii Muscles

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Forty-six steer carcasses were used to evaluate Warner-Bratzler shears and cooking losses of Triceps brachii (TB) and Psoas major (PM) muscles from sides assigned to three treatments: 1) conventionally chilled at 2.2 C for 48 hr (C), 2) hot boned at 2 hr postmortem (HB), and 3) electrically stimulated at 1 hr postmortem (400 to 600 V, 5 amps, 60 Hz of AC current) and hot boned at 2 hr postmortem (ESHB). Steaks were removed immediately after muscle excision and after 6 days aging. Steaks were cooked from the frozen or thawed state and some steaks were blade tenderized. HB and ESHB TB steaks cut after muscle excision had higher shear forces than C counterparts for steaks cooked frozen or thawed. Shear forces of C, HB, and ESHB groups for vacuum-aged (tenderized and non-tenderized) TB steaks were not different ($P > .05$). PM steaks from HB and ESHB groups cut after muscle excision and cooked thawed and those vacuum-aged (tenderized and non-tenderized) had lower ($P < .05$) shear forces than C counterparts. Shear forces for PM steaks cut after muscle excision and cooked frozen were similar for all three treatments. Cooking losses for C, HB, and ESHB groups were similar for all steaks and muscles. Electrical stimulation did not improve the hot-boning technique and the TB muscle required aging to be successfully hot boned.

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Antibacterial and Competitive Nature of Molds Isolated from Aged Beef

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The antibacterial and competitive nature of the molds *Thamnidium elegans, Mucor mucedo* and *Chaetostylum fresenii* commonly isolated from beef aging at refrigeration temperatures for extended periods were examined. An agar plate method revealed no growth inhibition of several meat spoilage or pathogenic bacteria by the molds examined. Eye round (semitendinosus) roasts were inoculated with spore suspensions containing 9 strains from the three fungal species and incubated for 48 hours at 4° or 18°C. Initial aerobic bacterial counts (35°C) on the meat samples were 2.4×10^4 bacteria/cm^2. Mold treatment had no significant effect ($P < 0.05$) on reduction of aerobic bacterial counts (35° and 7°C), coliforms, or fecal streptococci when compared with uninoculated controls. No surface fungal growth was evident after 48 hours at 4°C; appreciable mycelial development was apparent after 48 hours at 18°C. It was concluded that *Thamnidium elegans, Mucor mucedo,* and *Chaetostylum fresenii* are not capable of reducing or controlling bacteria on meat surfaces at refrigeration or elevated temperatures.

Nucleic Acid Content and pH of Bovine Marrow, Muscle and Mechanically Deboned Meat

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Deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) contents of marrow from cervical and lumbar vertebrae of 20 Utility grade cows, 20 Choice grade steers, and 20 Choice grade heifers, were determined. Twenty different lots of mechanically deboned beef (MDM) and 20 longissimus muscle samples from Choice beef were also analyzed. Nucleic acids were extracted by an alkaline hydrolysis procedure which separated RNA from DNA. Mean DNA and RNA values are expressed in mg/g protein. Cervical marrow DNA was highest at 191.3 for cows as compared to 166.8 for steers, and 164.1 for heifers. Values for lumbar marrow DNA from cows, steers and heifers were lower than for cervical marrow at 105.7, 159.6, and 129.1, respectively. A similar trend was observed for RNA values. Cervical marrow RNA was higher at 16.4, 18.8 and 14.3 than for lumbar marrow at 11.0, 12.7 and 11.8 for cows, steers and heifers, respectively. Muscle had considerably less nucleic acids than marrow or MDM, with DNA values of 7.8 and 49.9, and RNA values of 1.7 and 4.8 for muscle and MDM, respectively. Mean pH values were 7.3 for marrow, 6.2 for MDM and 5.8 for muscle indicating that the increased pH of MDM over muscle was due to marrow in MDM. Increased pH values in MDM could serve as a guide for estimating amount of nucleic acid or marrow present. Control of nucleic acids may be important since a high intake of nucleic acids is suspected to be detrimental to hyperuricemic, leukemic, and even healthy individuals.

Electrical Stimulation and Carcass Tensioning: A Combination Method for Tenderness Improvement

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A study was designed to study the combined effect of both electrical stimulation and tensioning of carcasses on tenderness. Five cows and five lambs were used. Each carcass was split into sides: one side was electrically stimulated while the other was both electrically stimulated and tensioned. At five time intervals between 0 and 48 hours post stimulation, pH and temperature were measured in the semimembranosus, longissimus dorsi and triceps brachii. At 48 hours post stimulation steak samples were taken from the semimembranosus and longissimus dorsi for Warner-Bratzler shear test and measurement of the sarcomere length and fiber diameter by phase-contrast microscopy. Tensioning plus electrical stimulation produced 12.5% and 3.4% decrease in shear force as compared with electrical stimulation alone in the semimembranosus and longissimus dorsi muscles respectively. Shear force decreases were similar in both cows and lambs. Longer sarcomeres and larger fiber diameters were also observed in tensioned muscles. These results suggest that the tenderizing effects of electrical stimulation and tensioning are additive. Further study is recommended to examine the mechanism of this combination method.