GRADUATE STUDENT RESEARCH PAPER COMPETITION

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Presiding

RESIDUAL NITRITE AND TOTAL MICROBIAL PLATE COUNTS OF HAMS AS INFLUENCED BY TUMBLING AND FOUR INGOING NITRITE LEVELS

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The effects of tumbling (tumble 10 minutes each hour) and ingoing nitrite levels (0,40,80 and 120ppm) on residual nitrite and on surface and subsurface (1.5cm below the surface) total plate counts were evaluated in 80 boneless, defatted cured hams. Microbial data was obtained during the tumbling process (0, 12,15, and 18 hours), after cooking and after 7 days storage at 3°C. Residual nitrite was evaluated after 18 hours of tumbling (precook), after cooking and after storage. Hams were scored for color and cohesiveness. Also, yield data were collected. Neither surface nor subsurface total plate counts changed significantly during the tumbling process. After cooking and storage, total plate counts for tumbled and nontumbled hams were not significantly different. Each of the three nonzero levels of nitrite significantly reduced surface total plate counts in both tumbled and nontumbled hams during the tumbling process. A similar trend was observed for subsurface samples; but, the difference was not significant. After cooking and after storage, ingoing nitrite levels showed no significant effects on either surface or subsurface total plate counts. Residual nitrite in hams tumbled 18 hours was lower than that in nontumbled hams. This difference was not observed following cooking or storage. As expected, yields, color scores and cohesiveness scores were all improved by tumbling.

EFFECTS OF REDUCTION OR PARTIAL SUBSTITUTION OF SODIUM ON BOLOGNA CHARACTERISTICS AND ACCEPTABILITY

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Bologna was prepared in 3.6 kg batches with different neutral salts, phosphates, and ionic strengths (IS). Nine treatments consisting of three salt types (sodium chloride (NaCl), potassium chloride (KCl)-NaCl, magnesium chloride ($MgCl_2$)-NaCl) and three levels (high IS (0.42), low IS (0.21) and low IS with .13% K_3PO_4) were used in different batches. Low IS treatments were less firm and stable than both high IS and low IS with K_3PO_4 treatments. Low IS treatments were significantly ($P<.05$) lower than high IS and low IS with K_3PO_4 for raw emulsion extrusion (1.43, 1.50 and 1.55 kg/10 gm, respectively) and compression hardness (57.7, 82.2, 79.4 kg, respectively). Also, significantly ($<.05$) higher values for low IS were found for emulsion stability cook loss (4.3, 1.6, 1.3 ml, respectively) and compression elasticity (4.9, 3.2, 2.4 mm, respectively). The K_3PO_4 added to low IS level made the product characteristics similar to high IS level treatment. The NaCl-$MgCl_2$ treatments were less firm and stable than NaCl or NaCl-KCl treatments in a manner similar to the low IS treatments. Little differences in product characteristics between NaCl and NaCl-KCl treatments were found. Treatments subjected to consumer panels were all acceptable for flavor, texture and color. Low IS NaCl-$MgCl_2$ with K_3PO_4 had significantly ($P<.05$) lower flavor likeness than low IS NaCl with K_3PO_4, high IS NaCl, and high IS NaCl-KCl treatments.

THE EFFECT OF VACUUM AND MIXING TIME ON THE EXTRACTABILITY AND FUNCTIONALITY OF PRE- AND POSTRIGOR BEEF

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This experiment was designed to determine the effects of vacuum mixing protein extraction and functionality of pre- and post-rigor beef. Beef muscles excised either pre- or post-rigor from cow chucks, were ground twice. Four hundred gm of mince was mixed with 1200 ml of Weber-Edsall solution for ½, 1½, or 2½ hr in a 4.5 kg capacity Keebler mixer. Post-rigor meat was mixed with and without vacuum and

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pre-rigor meat was mixed with vacuum. Following mixing, the muscle homogenate was centrifuged and the supernatent (sarcoplasmic plus myofibrillar proteins) were diluted to 0.04 M to precipitate crude myosin. Results indicate that significantly greater amounts of crude myosin were obtained due to vacuum treatment ($P<0.05$) with increased time of mixing ($P<0.05$). Vacuum seems to specifically increase myofibrillar protein extraction since vacuum had no effect on the protein content in the supernatent. Comparing pre- and post-rigor vacuum extracted meat, the former produced greater crude myosin yields over time ($P<0.05$). Protein functionality of crude myosin fractions was evaluated using binding ability and gel strength tests. Mixing the mince greater than ½ hr caused a decrease in binding ability and gel strength ($P<0.05$) irrespective of vacuum. Delineation of the functionality differences was attempted using α-helical content and thermal melting curves. Implications of effects of vacuum mixing duration in relation to processed meats is discussed.

FRANKFURTER PREPARATION FROM PRE-RIGOR BEEF, *S. L. Karow, B. B. Marsh, and J. V. Lochner*, University of Wisconsin, 1805 Linden Drive, Madison, WI 53706

This study was undertaken to examine the feasibility of preparing frankfurters from pre-rigor beef, the entire operation (including color development and cooking) to be completed within 3 hours of slaughter. Preparation followed normal practice to and including stuffing, with the exceptions that (1) the beef was less than 2 hours post-mortem when chopping commenced, and (2) sufficient lactic acid was added to the samples to reduce the pH to about 5.8, roughly that of normal-rigor meat. Sodium nitrite (120ppm) and ascorbic acid (500ppm) were included in the formulation. A two-step cooking system was first examined: microwave-oven heating to 54°C to arrest glycolytic changes, followed by slow waterbath cooking to 68°C. It was established that increasing the delay time between chopping and cooking resulted in somewhat lower acceptability and greater cooking loss, possibly due to ATP degradation. A different two-phase cooking operation, microwave to 54°C followed by smokehouse to 68°C, resulted in a product with better color, flavor and texture characteristics. Of all the cooking methods examined, however, the traditional one-step smokehouse cook gave the best product. Panel comparisons of this product with a commercially available wiener showed the experimental frankfurter to be at least equal to the commercial product. It is concluded that beef frankfurters can be prepared from pre-rigor meat, with obvious reductions in energy input, initial bacterial load, and space, time, and labor requirements.

EFFECT OF FIXATION TREATMENTS ON MUSCLE ULTRASTRUCTURE, *J. D. Thomas, H. B. Hedrick, and J. A. White*, University of Missouri, 1-74 Agriculture Building, Columbia, MO 65201

This study was conducted to determine the effect of differing fixation schedules on muscle ultrastructure. For fixation, .5mm^3 samples were removed from *semitendinosus* muscle that had been aged 10 days at 2°C and then frozen at −18°C. The fixation treatments consisted of: Treatment 1—3% glutaraldehyde in phosphate buffer for 3 hours, 1% osmium in phosphate buffer for 3 hours; Treatment 2—identical to treatment 1 except phosphate buffer was replaced with cacodylate buffer; Treatment 3—an equal volume mixture of 2% glutaraldehyde and 2% osmium in phosphate buffer for 1.5 hours followed by 1% osmium in phosphate buffer for 2 hours; Treatment 4—identical to treatment 3 except cacodylate buffer replaced phosphate buffer; Treatment 5—1% osmium in phosphate buffer for 3 hours; Treatment 6—1% osmium in cacodylate buffer for 3 hours. After each fixation step, samples were rinsed for 1 hour with several changes of fresh buffer. After final fixation, samples were stored overnight in fresh buffer. The pH of the buffer was adjusted to that of muscle. Other preparative steps were identical for all treatments. White fibers were used for observation. This was done to eliminate any differences between red and white fiber structure. All fixation schedules yielded acceptable results. With proper techniques any of the above fixation treatments can be employed to prepare muscle samples for electron microscopy. Treatments 5 and 6 are not generally recommended because osmium is not an effective protein fixative and has low osmolarity. Treatments 3 or 4 are recommended because of the time savings as compared to the more traditional fixation schedules of treatments 1 and 2.

EFFECTS OF CASTRATION AT VARIOUS WEIGHTS ON PORK CARCASS TRAITS, *K. D. Bitter, D. M. Kinsman, J. W. Riesen, and N. S. Hale*, University of Connecticut, Box U-40, Storrs, CT 06268

The effect of weight at castration was tested to de-

termine any variation in live and carcass characteristics of 25 male Yorkshire pigs. Castration weights were uniformly varied among five treatments (27.2, 45.5, 63.6, 81.8 Kg. and an intact group of 100 Kg.). All groups were confinement-fed an ad-libidum 16% protein ration. Live weights were recorded approximately every 14 days with no significant difference in gain ($P>.25$). Carcass data was collected within two days after slaughter. Carcass length and loin eye area increased ($P<.10$) and back fat decreased ($P<.025$) with increased castration weight. Primal cuts were removed from the left side and uniformly trimmed. Loin weight, % loin, % shoulder, and % 3-lean-cuts of the carcass were significant ($P<.005$) as was shoulder weight and 3-lean-cut weight ($P<.01$) as a linear function of castration weight. The anterior 1/3 of the belly was evaluated by a sensory panel for flavor and aroma of "pig taint." Detected flavor was significantly higher ($P<.005$) in the intact group. No significant interaction between animals and panelists or significant panelist effect was evident. Late castration yielded a leaner carcass with the major increase in the loin and shoulder areas. "Pig taint" flavor was detected by sensory evaluation of intact group, however, values expressed were not beyond a "small amount" of "tested flavor."