RESEARCH ABSTRACT

PORK QUALITY

Title: Biochemical Characterization of Pork Quality - **NPB#01-117**

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Abstract

Pork loin color and water-holding capacity are influenced by the rate and extent of postmortem muscle acidification (pH decline). The objective of this research was to determine the relationships between pork loin color, water-holding capacity, pH decline and 1) capacity of muscle ATPase activities, 2) buffering capacity, 3) capacity to generate ATP via creatine phosphokinase and myokinase reactions, and 4) protein denaturation. Pietrain or Duroc sires (Experiment 1) and Berkshire or Yorkshire sires (Experiment 2) were used to produce HAL-1843^{TM}-free offspring that exhibit contrasting pork quality traits. Sixteen pigs per sire breed were used. Loin quality and biochemical traits were measured on *longissimus* muscle samples removed between the 11th rib and the center of the lumbar region. R-values determined at 45 and 180 min postmortem, which increase with ATP utilization, were negatively correlated with 45 min and 180 min pH. R-values were also positively associated with 24 hour drip loss from loin chops (P<.02) and purge from vacuum packaged loin sections (P<.01). Although the rate of muscle energy utilization is undoubtedly linked to the activity of ATPases in early postmortem muscle, a faster or slower rate of energy utilization does not appear to be associated with a greater or lesser tissue capacity of myofibrillar or SR calcium-ATPases in pig longissimus muscle. Muscle buffering capacity was positively correlated with glycolytic potential (r = .53; P<.05) and fluid loss (r = .51; P<.05) in experiment two. The latter suggests that elevated buffering capacity may be an adaptation to more frequent or severe acidification of living muscle in some pigs, which also corresponds to production of inferior pork from these animals.

Creatine phosphokinase and myokinase activity at 24 hours postmortem was over 90% and 84%, respectively, of that present at 20 min postmortem. Myokinase activity (24 hours postmortem) was negatively correlated with purge from pork loin sections (P<.03). In Duroc and Pietrain pigs, the activities of both myokinase and creatine kinase at 24 hours postmortem were positively correlated with early postmortem pH (P<.05). The lack of relationship between enzyme activity derived from samples at 20-minute postmortem and early postmortem pH suggests that a greater quantity of these enzymes does not provide a sparing effect on early postmortem glycolysis. Reduced activity of these enzymes and the myofibrillar ATPase, which was also positively correlated with early postmortem pH and negatively correlated with drip loss (P<.05) in experiment one, suggest that denaturation and reduced solubility of both myofibrillar and sarcoplasmic proteins is associated with reduced water-holding capacity. No consistent relationships were observed between denaturation of sarcoplasmic or myofibrillar proteins and pork color. Collectively, these data suggest that inferior pork water-holding capacity is caused by accelerated ATP utilization and pH decline that leads to protein denaturation. Accelerated ATP utilization is not associated with an increased quantity of ATPases or an insufficient quantity of ATP-generating enzymes. Physical or psychological stressors may trigger elevated ATP utilization, or rapid ATP utilization may result from a metabolic disorder similar to that created by the Hal-1843 mutation, which results in abnormal calcium homeostasis.