

## **Management Factors that Affect Meat Quality**

Debate about meat quality has been ongoing for years, but the term ‘meat quality’ remains poorly defined in the U.S. swine industry. In the past, quality referred to carcass leanness. Breeding stock producers focused selection on increasing leanness and reducing fat in the carcass. Packers at first rewarded producers of lean pigs with carcass premiums, and later discounted fat pigs with lower prices. Quality discussions have since evolved from a sole focus on leanness to factors that influence taste and overall eating experience. The Japanese meat industry has done an excellent job defining meat quality characteristics that are important to their consumers, and they are willing to pay more for product that meets their specifications. What is considered good quality pork in the U.S. is very different from what is acceptable in Japan. Even within the U.S., what constitutes good quality may differ between two segments of the industry (i.e., the restaurant and supermarket trade), and these quality indices may be different from what consumers actually prefer. Before change will occur in our industry, meat quality must first be defined, then be measurable, and finally, be rewarded financially.

In the U.S., packers focus on avoiding PSE (pale, soft, exudative) and dark, firm, dry (DFD) pork. These conditions are related to muscle pH, both the rate of pH decline and ultimate (24 hr postmortem) pH. The pH is directly related to water holding capacity (WHC) of the muscle. PSE and DFD are two quality issues that occur when pigs are excessively stressed prior to slaughter. Stressed pigs metabolize glycogen in muscle, producing lactic acid as a by-product. Rapid build up of lactic acid in muscle just prior to slaughter causes an extremely rapid decline in pH, resulting in PSE pork. DFD occurs when pigs have time to clear lactic acid from muscle but not enough time to replenish glycogen stores, leading to low ultimate pH. If the industry can supply pork of acceptable WHC, processors can pump, cure, marinate, or chop it to produce good tasting, further processed product.

Both the amount of preslaughter stress and a pig’s ability to handle it influence the incidence of PSE pork. High levels of stress can cause PSE in any pig regardless of genotype. Relatively low levels of stress in genetically predisposed pigs can cause PSE. Producers must understand pigs’ susceptibility to stress and ability to deal with it if reductions in PSE are desired. Pigs genetically predisposed to stress usually carry at least one of the following genes: halothane (stress) gene or Rn (Napole) gene. The halothane gene causes a rapid decline in pH, whereas the Rn gene causes low ultimate pH. Elimination of these two genes from the swine population should reduce the frequency of PSE pork. However, these stress-related genes are prevalent in the U.S. swine population because both are linked to traits that improve carcass leanness.

Other factors related to PSE involve stress before and during the harvesting process, including loading, transport, duration of stay at the packer prior to harvest, harvest technique, and post-mortem handling. Producers control some of these factors and others are managed by packers.

For producers, new building technologies such as large pens with automatic sorting scales may offer advantages in reducing PSE pork. To manage large pens effectively, producers must walk pens, allowing pigs to get used to people. The new technology also sorts pigs automatically into desired groups with relatively little stress. Large pens may reduce fighting prior to loading as well as on trucks and at the packer. The loading process is a critical control point for PSE reduction strategies. Alleyways should be no wider than the width of two pigs standing side by side, and should have solid walls or panels in place to keep pigs' attention focused ahead. Pigs will load more easily if alleyways and truck interiors are well lighted. Small groups of pigs (i.e., 4-5 per group) should be loaded at a time without the use of electric prods. Finally, pigs should be taken off feed 12 to 24 hours prior to harvest. This technique not only saves feed costs, it also reduces death loss during transport and enhances evisceration due to reduced gut fill.

Fighting amongst pigs in lairage at the packer negatively affects meat quality. Pigs should be given at least two hours rest after unloading prior to harvest. At most packing plants, pigs from one semi-load are placed in the same pen. If pigs come from large pen finishers, they most likely will not fight during lairage, although if they come from conventional barns and are mixed, fighting can be severe. The harvesting process has the single largest impact on pork quality. Pigs should be slaughtered with as little stress as possible. In one study, halothane positive pigs were anesthetized thirty minutes prior to slaughter, with no reported instances of PSE pork. Preslaughter stress, including problems moving pigs to the slaughter area, pigs struggling prior to stunning, improper stunner settings, or spraying pigs with the wrong temperature water, can result in PSE pork.

Carbon dioxide (CO<sub>2</sub>) is a humane stunning method that typically reduces stress in pigs, but is more expensive than electrical methods. If electrical stunners are set too low, pigs struggle excessively, increasing stress. Too high a setting results in excessive muscle contraction and broken spines. After stunning, the interval to stick is critical and should be less than ten seconds. Bleeding pigs immediately after stunning not only removes hot blood quickly, reducing body temperature and preventing bacterial growth, but also reduces blood splashes in lean tissue. Rapid chilling prior to the onset of rigor will help improve meat quality. However, if the chilling process is too rapid (-22° F blast chilling), it may lead to frozen crust on the outside of the carcass, resulting in cold shortening and tough meat. The goal is to chill the thickest part of the ham to <86° F as quickly as possible, and to achieve <50° F within 12 hours postmortem. Assuming a 24-hour chill, deep ham temperature should be <40° F prior to fabrication. At this time, rigor has begun and meat quality is already determined.

In summary, quality traits for pork need to be better refined and measured at line speed so that producers can grow pigs to reach these standards and be rewarded by packers for producing high quality pork. In the interim, many factors have been identified that, when controlled, will improve basic meat quality traits or at least reduce the incidence of PSE and DFD pork. Those factors under the control of producers, truckers and packers should all be evaluated and strategies implemented so that, as an industry, we can produce the highest quality product possible.