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Pork Industry Handbook – Pork Quality

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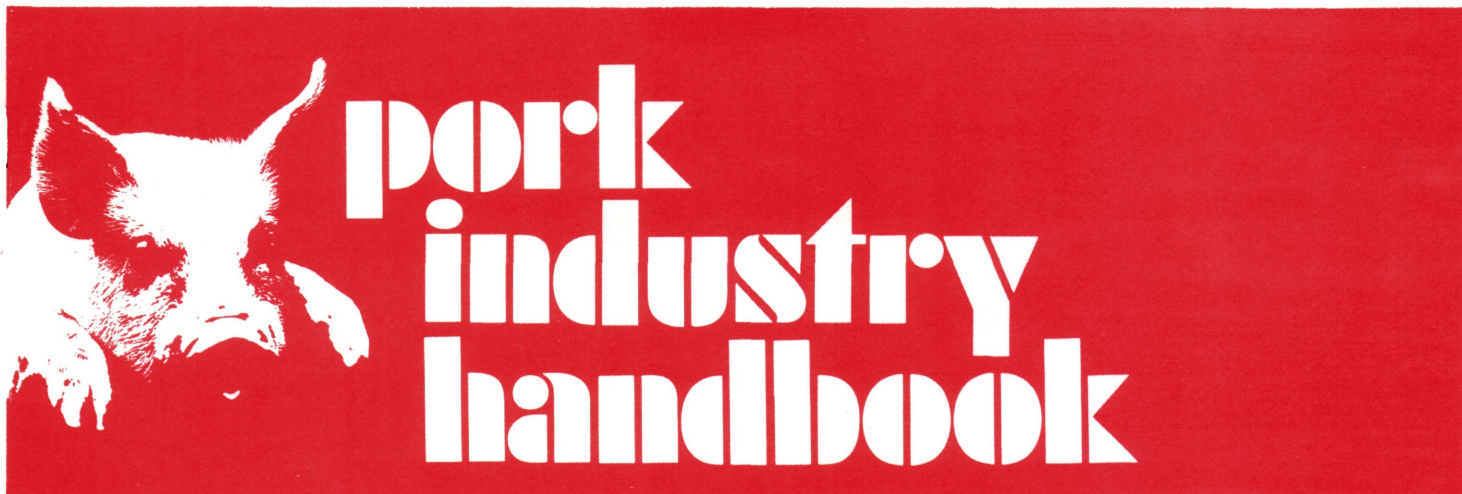
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Pork Quality

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“Pork Quality” means one thing to the industry but may mean quite another to consumers. Lean carcasses, high-yielding cuts, attractive appearance, and stability in cold storage are all characteristics that might be considered in the industry to be some of the most important aspects of high-quality pork. The ultimate objective of pork production is to provide food for people, therefore, the industry must focus upon and understand the definition of quality by consumers.

Consumer evaluation of pork quality occurs in the choice of pork when purchased at the retail store or restaurant and in the eating satisfaction experienced during consumption. Consequently, consumer-perceived pork quality may be divided into two major areas: those affecting appearance (and thereby selection) and those affecting eating satisfaction (and thereby repeat sales). Nutritional value and food safety are also becoming important issues to consumers.

Appearance Characteristics

Lean muscle color helps establish consumer impressions of quality. A bright reddish-pink is sought as an ideal; some variation of color is normal such as the different muscles of a ham. However, muscle color changes quite easily, and as a result can be indicative of meat quality. For example, as meat loses freshness and surface bacterial numbers increase, color may lighten and fade to a gray tone. If dehydration occurs under poor packaging conditions, color may also darken due to the concentration of the pigment. These color changes thus indicate quality changes in the product.

A more common color change results from the porcine stress syndrome (PSS), where animals with genetic susceptibility to stress react adversely to shipping and handling before slaughter. Animals with severe PSS may die before slaughter. Those that survive transportation to a slaughter facility usually result in very low quality pork with poor color. Meat from these surviving animals is most frequently pale, soft and exudative (PSE). The color is a very pale washed-out pink, which quickly turns gray or even greenish-gray in retail display. These cuts will also be soft and will lose excessive amounts of water from the muscle; causing a watery exudate to form puddles on and around the cut in a package. Obviously, the PSE condition results in an unattractive product for retailing and one which is lower in eating quality even though it is completely wholesome. Because of the water losses (which are increased even more during cooking), PSE pork results in a dry sensation when eaten and may seem tougher due to the dryness. The PSE muscle also loses considerable weight due to the water losses; consequently, yields are poor in processed products such as ham. Other quality defects from PSE muscle in processed products include excessive purge (free fluid) in packaged products, poor slicing characteristics, mushy texture, and uneven color distribution.

The PSS condition can also result in a dark muscle color though it is less common than the pale color from PSE. This dark, firm, and dry (DFD) product is just the opposite of PSE. However, it can also be unattractive because the consumers may interpret the dark red color as indicative of meat from an old animal, meat that lacks freshness, or meat that has been

dehydrated from improper storage. The PSS pork carcass can, in some instances, even result in a normal lean pork color.

The PSS-pork quality relationship has been recognized for many years, but it has recently become critical as U.S. packers attempt to compete in the world market. Buyers in the world market, particularly the Japanese, are very quality conscious. Therefore, PSE pork must be screened out of shipments from U.S. packers to Japan. This results in a greater proportion of PSE pork entering domestic markets. Because current information indicates that about 15% of the carcasses in the industry may be PSE, the amount of PSE pork on the domestic market could reach large proportions (30% or more). This would have a strong adverse effect on consumer perceptions of pork quality in the United States. There is a wide range of reports on the actual incidence of PSE carcasses observed. Some plants report 5% or less while others complain of nearly 30% of the carcasses as PSE.

Controlling the PSE problem would be a major step forward in the overall improvement of pork quality. Three solutions to this problem exist. First, the problem is clearly genetic. Testing and screening animals to eliminate the PSS tendencies from a herd is possible and has been described in Pork Industry Handbook fact sheet PIH-26, "Porcine Stress Syndrome." Unfortunately, there have not been any major economic incentives for pork producers to do so. However, a major pork processing company recently announced it will be measuring PSE levels and buying pork from slaughter companies on the basis of quality. If this system is extended to carcass evaluation for PSE and subsequently to pork producers, there may be considerable incentive to determine and eliminate the PSS. An important contribution to this solution is accurate and rapid measurement of carcasses for PSE. Electronic technology has been developed which offers good potential, but none of the instruments developed so far has been completely effective.

A second approach to reducing PSE is improved animal handling to reduce stress before slaughter. Animals seem to be especially vulnerable to stress during climatic changes and fluctuating temperatures. In addition, a 2- to 3-hour rest after shipping is effective. The thoughtful design of animal handling facilities and careful animal handling procedures also reduce stress.

Third, carcass chilling rates need to be as rapid as possible because many slaughter facilities have found decreased incidence of PSE by improved chilling. This includes decreasing the time from slaughter to chill as well as increasing the chilling efficiency. It should be noted that the PSE-quality problem is not an "either/or" situation. The degree of quality loss varies with the degree of PSE, which can range from slight to extreme. Improvements in handling and chilling will not eliminate quality losses but will lessen the degree and the incidence rate of low-quality pork.

While muscle color serves as a reasonably good indicator of PSS, it is not always an accurate indicator because color is not the first quality characteristic lost as PSE develops. Rather, water-binding losses occur first in the muscle during PSE development, which means that pork can be watery without a drastic color change.

The PSS-PSE problem is probably the best example of a relationship between visual appearance of pork and eating satisfaction. There are other appearance characteristics that are important to consumers. These include bone content, fat trim, and intramuscular fat (marbling). Bone and external fat trim are convenience factors that influence edible meat yield. They have little to do with eating enjoyment, however. Marbling, on the other hand, contributes to juiciness and flavor of cooked products and may improve tenderness slightly. Research indicates that a minimum of about 4% of the muscle (small amounts of marbling in quality standards) as intramuscular fat is necessary for a high level of palatability of fresh pork cuts.

Product packaging plays an important role in product appearance. Packaging may have little to do with inherent pro-

duct quality, but can have a great deal to do with retention of quality during storage. Packaging contributes significantly to the visual impact needed in retail displays. An attractive package is an important contributor to visual impressions of quality. However, consumers should be informed that the color of pork is dependent on the type of packaging films utilized. Conventional packaging allows passage of oxygen and produces a bright color. Newer types of vacuum packaging which achieve a longer shelf life, may result in a slightly different color (more purple as opposed to pink). This color change is slight for pork and is, in fact, probably insignificant unless the two packages were compared side-by-side.

Factors Important to Eating Satisfaction

Eating satisfaction occurs when a product is tender, has a certain minimum juiciness and contains a pleasant, well-rounded flavor. Water retention by meat during cooking is important to these characteristics. Intramuscular fat content is important because it contributes not only to juiciness but also to pork flavor. The fat component in muscle can be modified by the type of fat consumed by the pig. For example, fish meal and other oily fat sources, if fed to pigs, have been shown to result in off-flavored pork. Thus, fat flavor may influence the perceived overall quality of pork flavor.

Fat is susceptible to change during storage of meat since unsaturated fatty acids may develop rancid flavors. Cold temperatures and good packaging are the best ways to reduce flavor losses. However, even in frozen storage, pork will lose flavor quality in a few months.

Preparation methods (cooking temperatures, oven types) can greatly influence the eating quality of pork products. For example, consumers usually overcook pork because of traditional recommendations and fear of trichinosis. Trichinosis remains a concern because about 110,000 infected hogs are slaughtered each year. See Pork Industry Handbook fact sheet PIH-103, "Trichinosis." Cooking pork to a high internal temperature (such as the often-recommended 185° F) to destroy trichinae results in a dry, tough, unpalatable product. A lower internal temperature will improve eating satisfaction. Trichinae larvae are destroyed at 137° F (see PIH-103), however, most cooking recommendations suggest achieving an internal temperature of at least 160° F because of uneven internal temperatures which develop during cooking. Microwave cooking, however, is somewhat less lethal to the trichinae organism, and 170° F (internal) has been recommended for pork prepared in microwave ovens. It is also interesting to note that cooking raw meat in the microwave does not result in palatability characteristics identical to cooking in conventional ovens. Microwave ovens are appropriate for reheating products already cooked by conventional methods or for certain processed meat such as wieners and bacon.

Nutritional Value

Historically, consumers have not had a good impression of the nutritional quality of pork. Numerous studies have shown that pork products have been viewed as high in fat and cholesterol, difficult to digest, and low in relative value. Fortunately, in recent years, leaner hogs and closer trimming have resulted in much leaner cuts. It has been estimated that pigs are about 23% leaner than those previously produced. See Pork Industry Handbook fact sheet PIH-125, "Composition and Nutritive Value of Pork." Thus, consumers may now perceive pork to be a lean meat.

Educational campaigns have begun to achieve significant changes in consumer attitudes. For example, nutritionists have been aware for some time of the high-quality protein, iron, and B-vitamins supplied by pork products. For complete details on nutritional value, see PIH-125. Reducing the fat content of pork has diminished the consumer focus on fat in pork and has made

the positive nutritional qualities more obvious and more prominent. Today, consumers should not consider closely trimmed pork to be of low nutritional value. There has been a shift of consumer perceptions away from "fat pork" toward "lean, healthy pork."

Safety

Food safety is an issue that has become increasingly prominent. A safe food supply has been expected by consumers and delivered by the industry for many years. However, an increasing awareness of the potential for safety problems arising from changes in production practices and processing techniques has made consumers more determined that safety must be guaranteed. Public confidence in the safety of pork consumption is high, but a greater awareness of chemical, microbiological, and drug/antibiotic problems has made public confidence very susceptible to change. One news headline reporting an incident involving unsafe pork products could seriously damage consumer perceptions of pork quality and lead to decreased consumption and demand.

Most of the safety concerns in the past have been centered on pathogenic (food poisoning) microorganisms because meat provides a very good environment for microbiological growth. However, the food poisoning bacteria will not grow rapidly at refrigerated temperatures (below 40° F). In addition, spoilage bacteria in fresh meat which do not cause illness can grow in refrigeration and will generally cause spoilage (off-odors, off-color) before a product becomes unsafe. This means that on fresh meat the spoilage bacteria usually change a product before the illness-causing organisms reach large enough numbers to be harmful. One of the pathogens often found on fresh meat, *Salmonellae*, is easily killed by cooking and should not be a problem as long as cooked products are kept separate from raw products. Consequently, temperature control and good handling practices should assure the safety of fresh pork from microbiological hazards.

Processed pork products elicit somewhat different safety concerns because most of these products include either curing agents (salt and nitrite) or have been heated for control of spoilage. Because most spoilage bacteria are suppressed or killed by heat, pathogens may have a chance to grow—particularly if storage temperature is not well controlled. In these instances, salt and nitrite in cured pork provide protection and insurance against pathogens. One area of concern among microbiologists involves the uncured, cooked, packaged meat products intended for convenient microwave reheating. Many of these products have no salt or nitrite and refrigerated temperature control becomes extremely important to maintaining safety. The trends to reduced salt content and less fat in processed meats also represent a greater potential safety problem. These products have a higher available water (Aw) and are more conducive to microbial growth.

Because consumers have been well educated to thoroughly cook pork to eliminate trichinae, most pork is overcooked and less palatable than it would be otherwise. An alternative for control of trichinae is the irradiation processing of carcasses (recently approved by the regulatory agencies). Low-dose irradiation will control trichinae and permit use of lower cooking temperatures for pork. Irradiation has been clearly shown to be safe, wholesome, and effective but consumer attitudes toward irradiation processing, while yet to be determined, appear to be largely negative.

Safety concerns about chemical compounds used in pork products for processing and preservation, particularly sodium (from salt), nitrite, and antioxidants such as BHA and BHT, have been raised as issues. However, consumers should recognize that these compounds control spoilage, inhibit pathogens, and contribute to safety and overall quality. Recent research has better-defined the appropriate use of these ingredients to achieve the best compromise for safety and overall product quality. In most cases, lower levels of the compounds are used in the industry than were previously believed to be necessary.

While chemical and microbiological safety are determined largely by the packer and processor, the more recent focus on antibiotic and drug residues in meat is a primary responsibility of producers. Antibiotic and drug residues represent a very legitimate and serious concern of consumers. There are good scientific reasons for avoiding human consumption of these residues. While they are effective for efficient production of market hogs, it is crucial to the public trust that no significant residues remain in pork at the retail market. The most serious residue problem has involved sulfamethazine. However, all of the antibiotics and drugs used must be managed carefully to avoid residue problems. See PIH-86, "Management to Prevent Drug Residue Problems in Pork". Pork containing antibiotic or drug residues clearly diminishes the consumer concept of pork as a high-quality food.

Summary

The term "pork quality" conveys different messages to different people. To pork processors, it relates primarily to functional properties and color of the muscle. To retailers, it relates to appearance of retail cuts, including fat and bone content, as well as color and juice loss or retention. To consumers, any factor that affects pork eating satisfaction, safety, convenience, and nutritional value may fall within the definition of pork quality. Pork producers must recognize all these requirements and use the management practices that maximize pork quality for the entire industry. A sound breeding program that minimizes problems like PSS, a careful feeding program to eliminate residues while producing lean pork, and well-controlled marketing programs to avoid excessively fat hogs are all important components of an overall effort to maximize quality.



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