...TIONS IN PORK QUALITY: A 1991 U.S.A. SURVEY

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...RACT: During July and August, 1991, 14 pork processing plants (40% of the nation's hog slaughter) were ...veyed. The gluteus medius of 10,753 hams was subjectively scored for color, firmness-wetness and marbling. ...ed on color and firmness scores, hams were categorized as either PSE (Pale, Soft and Exudative), DFD (Dark, ...and Dry), RFN (Reddish-pink, Firm and Non-exudative), or RSE (Reddish-pink, Soft and Exudative). Three-...ths of the observations were soft and floppy and one-third were either too pale or too dark. Over 90% ...ained less than small quantities of marbling. When color-firmness characteristics were combined, only 15% ...s identified as RFN ('ideal') whereas 16% were PSE and 10% were DFD. More than half the hams were RSE ...tionable quality) due to their firmness-wetness even when color was acceptable. One plant possessed a 33% ...idence of PSE (the minimum was 6%), and the incidence of DFD ranged from 4 to 18%.

...ODUCTION: We believe the quality of pork is changing as a result of continued emphasis on producing leaner ...more efficiently and as slaughter and processing is conducted more rapidly. There is a suspicion that ...ity of the retail product is becoming less desirable and that the consumer is sensing the cooked product is ...ker and less juicy when consumed. Texture of pork seems softer and more watery. Overall, there appears to ...e a great variation in quality of pork. The problem is there is no recorded assessment or tracking of pork ...lity during the past 25 years. So, we cannot make an informed judgement about trends in quality and thereby ...ate characteristics of the meat to consumer likes and dislikes. If indeed quality is deteriorating and ...coming more variable the point may be reached where consumers object seriously or even reject pork.

...With all of this in mind, we decided to conduct a survey of pork quality. The goal was to establish if there ...s variation in muscle quality sufficient to warrant concern for the industry. The aim was to examine fresh ...ork from a number of commercial hog slaughtering plants in several areas of pork production. The survey was ...nducted during the summer of 1991 and should therefore be considered preliminary since it was done during ...only one season of the year.

...TERIALS AND METHODS: Fourteen hog slaughtering plants were surveyed during July and August and they ...presented eight companies located in eight states. We estimated that the number of hogs slaughtered by these ...lants was about 40% of the nation's total. Varying time periods were spent in each plant. All names and ...ocations of plants were kept confidential as the primary aim was to assess quality variation - not company ...differences. A total of 10,753 hams representing as many carcasses were included in the survey.

...Before starting data collection, the evaluators carefully compared color, firmness/wetness and marbling ...scores (described in the 1991 'Procedures to Evaluate Market Hogs' bulletin) with actual variations on the ...gluteus medius muscle surface as it appeared on a commercial pork-cut line. This muscle was chosen because it ...is one of the major muscles that is subject to quality variation, and one that is accessible for visual ...observation when the chilled carcass is being cut. These three visible quality variables were used because ...they were considered to be those most closely related to pork quality and that could be subjectively appraised ...under practical commercial conditions. Each set of scores was based on a 5-point scale (Fig. 1).

During their preparation for the survey, the two evaluators independently scored hams possessing gluteus medius muscles varying widely in quality. They compared their results to insure that each was consistent with the other and that their scores agreed with the NPPC standards. This was important because during the survey the evaluators alternated in scoring and recording data.

When the evaluators arrived at a plant, they first became familiar with the pork-cut line and then chose a well lighted logistical location in which to make their observations. Within one minute after a ham had been cut from the carcass, it was evaluated. At random, a ham was removed from the line and the evaluator would subjectively score for color, marbling and firmness/wetness (by physically touching the cut surface of the gluteus medius after removing any fat smears and/or excess water resulting from the cutting procedures). The other evaluator would record the information. This procedure progressed at the rate of one ham every 30 seconds for a period of 10 minutes. The evaluators took a 5-minute break and then began again in reversed roles. This routine continued until the cut line stopped. Approximately 300 hams were evaluated on any given day. Occasionally, internal ham temperature was measured.

For ease of interpreting the final results, the color and firmness/wetness scores were grouped in various combinations according to Fig. 2.

All data were sorted according to quality characteristics, plant of origin, day of week and evaluator. In addition to calculating percentages of observations related to each quality group, chi square analyses were performed to assess significant interactions.

RESULTS AND DISCUSSION: The average line speed for the 14 plants was about 850 carcasses/hr and the time from stunning until the carcasses were moved into the chiller ranged from 25 to 45 minutes. Some plants chilled the carcasses rapidly using sub zero temperatures to surface freeze the carcasses, whereas other plants used more conventional chilling systems and in some instances, packed the carcasses so tightly, that chilling efficiency may have been reduced.

Each evaluator examined similar numbers of hams, and when each of their sets of data were examined separately, the results were similar to the combined results.

There were significant interactions between day of week and plant location. However, these interactions were anticipated and there was little that could be done statistically to adjust the final results. Figs. 3 and 4 represent the results when all plants were combined, day of week was not considered, and when all hams were sorted into the four major quality groups. The groups are identified as RFN (Reddish-pink, Firm and Non-exudative) or 'IDEAL' quality pork, RSE (Reddish-pink, Soft and Exudative) or questionable quality pork, PSE pork and DFD (Dark, Firm and Dry) pork.

The U.S. has a pork supply that contains about 16 % PSE and 10 % DFD, both representing proportions that should be alarming and of concern to the industry. This variation is shared by all companies, yet some have less than others. It is important to remember this was a single survey at one specific time of the year, and that there was no attempt to determine the reasons for the variations observed. It is known that a number of factors are related to pork quality including genetics, nutrition, time of year (temperature and humidity levels and fluctuations), handling procedures on the farm and during transit to the packing plant, care of the

Figure 1. Description of Quality Scores

Score	Color	Firmness/ Wetness	Marbling
1	pale pinkish gray	very soft, floppy & exudative	devoid to practically devoid
2	grayish pink	soft, floppy & exudative	traces to slight
3	reddish pink	slightly firm & moist	small to modest
4	purplish red	firm & moderately dry	moderate to slightly abundant
5	dark purplish red	very firm & dry	moderately abundant or greater

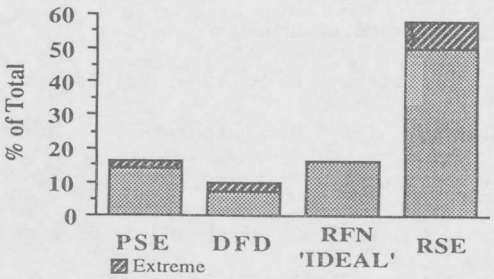
Figure 2. Description of Quality Groups

Color Scores	Firmness/ Wetness Scores	Description	Groups
1	1 & 2	very pale, soft & exudative	PSEx
2	1 & 2	pale, soft & exudative	PSE
1 & 2	3,4 & 5	pale, firm & non-exudative	PFN
3	1 & 2	reddish pink, soft & exudative	RSE
4 & 5	3,4 & 5	reddish pink, firm & non-exudative	RFN
4	1 & 2	dark purplish red, soft & exudative	DSE
5	3,4, & 5	dark purplish red, firm & dry	DFD
	4 & 5	very dark purplish-red, firm & dry	DFDx

Figure 3. Overall Distribution of Color Firmness and Marbling (N = 10, 753)

	%	
COLOR		
Pinkish gray	16.2	
Reddish pink	65.8	100.0
Dark purplish red	18.0	
FIRMNESS		
Soft (scores 1-2)	74.0	
Firm (scores 3-5)	26.0	100.0
MARBLING		
Devoid to practically devoid	56.5	
Traces to slight	36.8	
Small to modest	5.7	100.0
Moderate to slightly abundant	0.9	
Moderately abundant or greater	0.1	

Figure 4. Overall Quality Distribution



ys after arrival at the packing plant, method of stunning and method of chilling after slaughter. If the survey were repeated, somewhat different results would be expected. However, the present results give some perspective of what may exist in general for this industry. This is the first major survey that has been conducted in the past 30 years, and, at the moment, it's the best indicator available.

CONCLUSIONS: Pork quality is affected by both genetics and environment, and can be controlled if the industry so chooses. Some European countries, such as The Netherlands, have significantly reduced PSS through the elimination of halothane-positive boars in breeding programs. Also, Denmark's pork packers have developed model procedures to minimize stress prior to slaughter, using care in moving hogs to the stunning restrainer. These are two examples of how to minimize or eliminate variations in quality. We also know that marbling deposition is heritable, thus it can be selected for in breeding programs without jeopardizing carcass composition.

What should the U.S. pork industry do to guarantee that pork is not only lean, but that this lean is consistently firm, free of surface fluids, free of abnormalities, have a fresh appearing reddish-pink color and contain slight amounts of marbling? Here are four suggestions.

1. Guidelines should be established and practiced to insure acceptable production, management and welfare procedures at all times that include farrowing, weaning, feeding, handling, shipping and transporting, and pre-slaughter handling at the packing plant.

2. Procedures should be put in place to identify and evaluate every individual hog slaughtered. Procedures are needed to record and report abnormalities (via FSIS), carcass weight, leanness, and quality. Color, water-

holding capacity, pH (acidity) and marbling content should be recorded for each carcass. This information should be organized electronically and shared with producers so that appropriate steps can be made to improve breeding stock to eliminate quality variations. Working toward marketing all hogs on a carcass merit basis would be beneficial.

3. Pork packers, through cooperation with research organizations (industry, government, private and university), should evaluate procedures for pre-slaughter handling and post-slaughter processing that will minimize quality variation. Such factors as stunning and exsanguination, hot boning and rate of chilling need further attention.

4. The total value paid for all market hogs should not necessarily change, but the distribution of that total should reflect accurate value differentials (as dictated by supply-demand forces) between desirable and undesirable quality. Similar to having price differentials for lean and fat carcasses, such differentials also should exist for variations in quality. Price differentials offered by packers can be one of the greatest incentives to generate change.

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