Processing Factors Affect Fresh Pork Color and Water Holding Capacity

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Summary and Implications

It is well understood that many producer inputs influence fresh pork quality. These inputs include swine genetics, nutrition and handling. It is necessary to develop harvest procedures that maintain the quality defined by pre-slaughter inputs. Maintenance of quality is a key component during the harvest and chilling phase of the pork production chain.

The results of this project are important because they demonstrate that subtle differences in the harvest process have the potential to improve fresh pork color and water holding capacity. Proteins that contribute to pork color and water holding capacity are damaged by a combination of high temperature and acid (low pH) conditions. The shorter duration of scalding used in this study resulted in an earlier initiation of carcass chilling, a slightly lower loin temperature 2 hours postmortem, and a higher loin pH 2 hours postmortem. The end result is an improvement in pork color and water holding capacity.

Introduction

Consistent production of high quality pork must receive significant attention if fresh pork produced in the United States is to compete successfully in the global market. A recent survey conducted for the National Pork Board found that defects in pork quality result in a $2.13 loss in value per carcass. A portion of the production of poor quality pork can be attributed to known sources of variation, such as the halothane gene and the RN gene. However, a great deal of the variation in pork quality cannot be explained. Early postmortem processing of pork carcasses is a vital link between producer inputs and final product quality. Carcass handling early in the harvest process (most notably efficient removal of heat) can also have significant influence over pork quality. Many recommendations developed to maintain pork quality during the harvest process have focused on rapid processing and initiation of chilling. Definition of how early postmortem harvest procedures can affect pork color and water holding capacity is necessary to develop new and updated approaches to improve pork quality, consistency, and value. This, in turn, will contribute to expanded markets for pork products in domestic and international venues. This project was designed to answer the question of how harvest procedures can influence pork quality and value.

Materials & Methods

The experiment was replicated on two occasions. Six hundred fifty five pigs were assigned to scald duration treatments (7.6 minute scald, n=311; 5.6 minute scald, n=344). The more rapid chain speed from exsanguination until the end of scalding resulted in the carcasses in the 5.6 minute scald group exiting the scald tank approximately 5 minutes earlier than carcasses in the 7.6 minute scald group. Loin pH (last rib) and temperature (6^{th} rib) were measured at a fixed location in the process chain as the carcasses entered the cooler (approximately 30-35 minutes postmortem). Loin pH and temperature were measured at 2 and 6 hours postmortem.

Loins from sixty-four representative carcasses from each treatment group were selected for quality evaluation immediately after fabrication 1 day postmortem. Fresh pork color (Minolta), firmness, drip loss, pH and temperature were measured. Samples from forty representative loins from each treatment group were evaluated five days postmortem at the Iowa State University Meat Laboratory. Purge loss, color (Hunter Lab Mini Scan (D65, 10° observer), pH, and star probe texture were measured.

Results and Discussion

The more rapid scald treatment resulted in approximately 5 minute decrease in the duration processing on the harvest floor. The 7.6 minute scald duration resulted in higher loin pH as the carcasses entered the cooler (approximately 30 minutes postmortem), but lower loin pH values at two hours postmortem. Scald duration did not influence ultimate pH. Temperature of loins in the 5.6 minute scald treatment group was lower than temperature of the control group at 2 hours postmortem. Treatment did not affect temperature at any other time point measured. Temperature and pH data are summarized in Table 1.

Table 1. Temperature and pH in pork loins during first 24 hours postmortem

	5.6 minute Scald	7.6 minute Scald	Treatment Significance
Time postmortem	**pH**		
30 min	6.5	6.6	$P < 0.05$
2 hours	6.4	6.3	$P < 0.01$
6 hours	6.3	6.3	Not Significant
24 hours	5.8	5.8	Not Significant
	Temperature		
30 min	41.0	41.0	Not Significant
2 hours	23.6	24.5	$P < 0.10$
6 hours	8.3	7.5	Not Significant
24 hours	5.3	5.3	Not Significant

The 5.6 minute scald treatment resulted in lower Minolta L* values (indicating darker pork; Table 2). However, treatment did not influence color intensity as Minolta a* and b* were note influenced by treatment. The shorter scald treatment tended to result in pork loin chops with lower hue angle values (indicating less discoloration). These observations were confirmed by results from the quality evaluation 5 days postmortem (Table 3). Reducing scald duration resulted in lower Hunter L values (darker pork), and a lower mean hue angle (less discoloration). Drip loss was lower in loins from carcasses in the 5.6 minute scald group (Table 2). However, scald duration did not affect purge lost in vacuum bags during a 5 day storage period (Table 3).

Table 2. Pork loin color and drip loss collected 1 day postmortem.

	5.6 minute Scald (n=132)	7.6 minute Scald (n=134)	Treatment Significance
Minolta L*	44.72	45.48	P < 0.05
Minolta a*	6.05	5.79	Not Significant
Minolta b*	2.87	2.99	Not Significant
Hue angle (degrees)	24.85	26.78	Not Significant
Drip Loss	2.15	2.79	P < 0.05

Table 3. Pork loin color and purge loss collected after five days of storage.

	5.6 minute Scald (n=81)	7.6 minute Scald (n=82)	Treatment Significance
Hunter L	44.53	45.56	P < 0.01
Hunter a	5.77	5.78	Not Significant
Hunter b	9.76	10.04	< 0.01
Hue angle (degrees)	59.43	60.10	< 0.05
Purge Loss (%)	0.79	0.83	Not Significant

These results support our hypothesis that improving chilling rate by decreasing processing time will improve pork quality. Altering the harvest process can influence the pork color and water holding capacity. Of importance is the observation that the shorter duration of scalding consistently resulted in darker pork loins that exhibited significantly less drip loss. A likely explanation for this observation is that the shorter duration of scalding resulted in a higher pH after the initial chilling period (2 hours postmortem). Additionally, the loins in the 5.6 minute scald group tended to be cooler (23.6 °C compared to 24.5 °C) than the loins from carcasses in the 7.6 minute scald group. The results indicate that small, but significant improvements in the consistency of fresh pork could be achieved by studying how slaughter processes can be altered. Although the results of the project do not represent processes at all harvest facilities, it is conceivable that similar process improvements could achieve similar results in other facilities.