

## PORK QUALITY

**Title:** Characterization of the Quality Attributes of Fresh, Pumped Pork Loins  
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## Characterization of the Quality Attributes of Fresh, Pumped Pork Loins

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Barrows (n=347) from a commercial crossbred line were harvested on two separate occasions to evaluate the effects of pump level, raw material quality (pH), and pump solution ingredients on pork quality. Boneless, paired pork loins (n=120) were selected based on 14 h pH and transported to the University of Illinois. Ultimate pH, drip loss, instrumental color (L\*, a\*, b\*), and proximate analysis were evaluated prior to pumping. Paired loins were cut into four sections and randomly assigned to one of four pump levels (0, 6, 12, or 18%). Loin sections were pumped to result in a product containing 0.4% sodium tripolyphosphate (STP) for experiment one (Exp. 1) and 0.4% STP and 0.4% salt for experiment two (Exp. 2). Pump retention, vacuum package purge loss, sensory characteristics, Warner Bratzler Shear (WBS), retail purge loss, and instrumental color (L\*, a\*, b\*) were evaluated. In Exp.1, increasing pump level increased ( $P \leq 0.05$ ) retention and purge. Increased pH significantly increased pump retention and reduced purge loss. A pump level by pH interaction was observed for cook loss at 70° C. In Exp. 2, increasing pump level increased pump retention ( $P \leq 0.05$ ). Purge loss from the 18% pump level was higher ( $P \leq 0.05$ ) than controls. Increased muscle pH consistently reduced purge loss and resulted in juicier, more tender pork. Pumped pork had higher tenderness, juiciness, and saltiness scores than controls. Pump level and pH had limited effects on WBS and cook loss. The results suggest that pump level and pH impact retention and purge but have limited effects on WBS, cook loss, and palatability attributes.

Pork Quality, Sodium Tripolyphosphate, Pumping, pH

## **Introduction**

As the industry has evolved over the past decade, the quality of pork relating to the consumer has become very important to the pork industry. From a consumer standpoint, pork quality is determined by two primary parameters. Those parameters are purchase intent and eating quality.

Purchase intent is primarily based on the appearance of pork products. Consumers typically select products that are reddish/pink in color, have low levels of intramuscular, intermuscular, and subcutaneous fat, and exhibit low levels of excess moisture in the bag or tray. Most pork products are consumed either in the home or in a restaurant in which eating quality generally determines repeat purchases. Therefore, tenderness, juiciness and flavor of the product determine whether a consumer returns to a particular restaurant or continues to purchase the product from a retail case. Based on this information, the meat industry has been evaluating technologies that would improve the factors associated with purchase intent and eating quality.

One of those technologies is enhancement. Enhancement is the use of a pump solution in a meat product to increase water retention and improve palatability attributes. The most common ingredient used in pump solutions is phosphate. Phosphates have the ability to increase water holding capacity and decrease purge loss while improving flavor and color. They do this by three primary mechanisms. First, phosphates increase muscle pH. This leads to increased water retention, decreased purge loss, and improved color. Phosphates also solubilize muscle proteins and play a large role in tenderness. Finally, phosphates demonstrate antioxidant properties. They have the ability to stabilize fatty acid volatiles that impart better flavor. The use of phosphates, however, is restricted. Phosphates can only be used at a level that results in no more than 0.5% in the final product.

As the meat industry has evolved, they have adopted the use of enhancement as a value-added technology to improve the palatability of fresh pork. The majority of major packers and processors merchandize a line of enhanced products. Today, approximately 30-40% of fresh pork is enhanced. The meat industry has identified several issues concerning quality and consistency in which there is limited research. Therefore, this project was conducted to characterize the effects of pump level, raw material quality (pH), and pump solution ingredients on pork quality.

### **Objectives**

The objectives of this research were as follows:

1. Characterize the effect of pump level (%) on quality attributes of fresh and cooked pork.
2. Characterize the effect of raw material quality (ultimate pH) on pump retention and subsequent quality of fresh and cooked pork.
3. Characterize the effect of pump ingredients on pump retention and quality of fresh and cooked pork.

### **Procedures**

Barrows (n=347) from a commercial crossbred line were harvested on two separate occasions. Boneless, paired pork loins (n=120) were selected based on 14 h pH and were transported to the University of Illinois. Ultimate pH, drip loss, instrumental color (L\*, a\*, b\*), and proximate analysis were evaluated prior to pumping. Paired loins were cut into four sections and randomly assigned to one of four pump levels (0, 6, 12, or 18%). Loin sections were pumped with 0.4% sodium tripolyphosphate (STP) for the

first experiment (Exp. 1) and 0.4% STP and 0.4% salt for the second experiment (Exp. 2). Pump retention, vacuum package purge loss, sensory characteristics, Warner Bratzler Shear (WBS), retail purge loss, and instrumental color ( $L^*$ ,  $a^*$ ,  $b^*$ ) were evaluated following a 12 d aging period at 2° C.

## Results

In Exp. 1, purge loss and pump retention increased as pump level increased. Increased muscle pH consistently improved pump retention and reduced purge loss. A

Ultimate pH									
Variable	STP			Avg SE	STP/SALT			Avg SE	
	Low < 5.50	Medium 5.50 to 5.60	High > 5.60		Low < 5.65	Medium 5.65 to 5.80	High > 5.80		
Pump Ret., %	101.9 <sup>a</sup>	102.6 <sup>b</sup>	103.0 <sup>b</sup>	0.264	103.7	103.3	103.9	0.270	
Purge Loss, %	5.43 <sup>c</sup>	4.68 <sup>b</sup>	4.06 <sup>a</sup>	0.183	3.82 <sup>b</sup>	3.69 <sup>b</sup>	2.93 <sup>a</sup>	0.172	
Tenderness	7.31	7.27	7.72	0.209	7.76 <sup>a</sup>	7.91 <sup>a</sup>	8.75 <sup>b</sup>	0.149	
Juiciness	6.69	7.07	7.36	0.201	7.44 <sup>ab</sup>	7.14 <sup>a</sup>	7.75 <sup>b</sup>	0.156	

  

Pump Level										
Variable	0%	6%	12%	18%	Avg SE	0%	6%	12%	18%	Avg SE
	Pump Ret., %	96.7 <sup>a</sup>	101.7 <sup>b</sup>	104.9 <sup>c</sup>		106.8 <sup>d</sup>	0.300	96.8 <sup>a</sup>	101.5 <sup>b</sup>	
Purge Loss, %	3.33 <sup>a</sup>	2.92 <sup>a</sup>	5.15 <sup>b</sup>	7.49 <sup>c</sup>	0.212	3.24 <sup>a</sup>	2.82 <sup>a</sup>	3.41 <sup>a</sup>	4.44 <sup>b</sup>	0.199
Tenderness	6.95	7.63	7.53	7.64	0.241	7.41 <sup>a</sup>	8.20 <sup>b</sup>	8.78 <sup>c</sup>	8.16 <sup>b</sup>	0.172
Juiciness	6.23 <sup>a</sup>	7.08 <sup>b</sup>	7.33 <sup>b</sup>	7.51 <sup>b</sup>	0.233	6.24 <sup>a</sup>	7.60 <sup>b</sup>	8.28 <sup>c</sup>	7.65 <sup>b</sup>	0.180

significant pump level by pH interaction was observed for cook loss at 70° C. In Exp. 2, pump level impacted pump retention showing increased retention with increased pump level. Purge loss was higher than controls at 18% enhancement. Increased pH consistently reduced purge loss and resulted in juicier, more tender pork. Pumped pork had higher tenderness, juiciness, and saltiness scores than controls. Pump level and pH had limited effects on WBS and cook loss. Pump level and pH had significant effects on retention and purge but had limited effects on WBS, cook loss, and palatability attributes. The results suggest that STP/salt combinations have advantages over STP alone, however, this comparison could not be made statistically.

Table 1. Least square means of pH and pump level for longissimus sections injected with STP or STP/salt

<sup>abcd</sup> Within a row, means without a common superscript letter differ ( $P \leq 0.05$ )

Pump retention and purge loss were significantly impacted by pump level and pH. The effects of pump level and pH on other variables were more limited. In conclusion, enhancement improves palatability and quality characteristics of pork products. With improved moisture retention and sensory properties, enhancement will continue to grow throughout the meat industry.