# Factors Influencing Tenderness In A Commercial Line Of Pigs

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## Introduction:

Tenderness is one of the primary factors that drives consumption of whole muscle pork products. Much of the research that explores the effects of meat quality traits on sensory properties has been performed on single genotypes, however the presence of purebred pigs in commercial production systems is minimal. With this in mind, it would be beneficial to understand how well typical meat quality traits predict sensory properties and shear force in a commercial line of mixed breed pigs.

## Objectives:

The objectives of this study were to:

1. Correlate sensory traits of fresh pork loins with typical meat quality measurements.
2. Determine which biochemical factors are responsible for different patterns of post mortem tenderization of fresh pork loins.

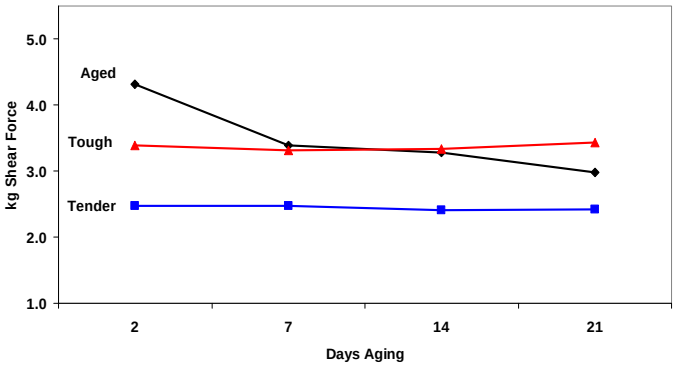
## Methods:

### Objective 1:

- A commercial population of pigs known to display differences in shear force were identified and utilized for our study.
- 3 trailer loads of pigs from the same production facility were harvested at a single plant on the same day.
- Data captured during harvest and chilling included pH at 45 min, 3 h, and 6 h, HCW, fat depth, and loin depth.
- Data collected at 48 h post mortem (10th rib) included ultimate pH, NPPC color, marbling, firmness, Minolta L*, a*, b*, 24 h drip loss, % moisture, and % extractable lipid.
- Shear force chops were cut and aged for 2, 7, 14, and 21 d.
- Trained sensory panel analysis of samples aged 14 d post mortem was conducted on chops cooked to 71°C.

### Objective 2:

- 3 subsets of loins (n = 10 each) were identified that displayed unique aging curves.




- Biochemical traits were measured to help explain these differences including glycolytic potential, hydroxyproline content, desmin degradation, and sarcomere length.

## Results:

### Objective 1:

Table 1. Pork quality summary statistics

| | Mean | Std Dev | Min | Max |
|---|---|---|---|---|
| pH (45 min) | 6.24 | 0.20 | 5.82 | 6.88 |
| pH (3 h) | 6.14 | 0.21 | 5.59 | 6.67 |
| pH (6 h) | 5.84 | 0.20 | 5.38 | 6.46 |
| pH (48 h) | 5.58 | 0.21 | 5.05 | 6.11 |
| Minolta L* | 45.96 | 2.98 | 39.46 | 53.08 |
| DripLoss (%) | 1.63 | 0.69 | 0.57 | 4.29 |
| Lipid (%) | 2.55 | 0.66 | 1.03 | 4.48 |
| Juiciness | 8.78 | 1.19 | 4.47 | 11.78 |
| Tenderness | 8.15 | 1.70 | 3.98 | 11.77 |
| Shear 2 | 3.18 | 0.62 | 2.08 | 5.26 |
| Shear 7 | 3.07 | 0.50 | 2.02 | 4.24 |
| Shear 14 | 3.07 | 0.51 | 1.94 | 4.43 |
| Shear 21 | 3.02 | 0.47 | 1.88 | 4.08 |

Table 2. Correlation coeffiecents of pH and quality traits[1]

| | pH45min | pH3h | pH6h | pH48h |
|---|---|---|---|---|
| Color | 0.02 | ***0.31*** | ***0.34*** | ***0.44*** |
| Firmness | 0.09 | 0.13 | 0.14 | ***0.27*** |
| Minolta L* | ***-0.26*** | ***-0.51*** | ***-0.54*** | ***-0.39*** |
| DripLoss (%) | ***-0.29*** | ***-0.53*** | ***-0.56*** | ***-0.59*** |
| Juiciness | 0.05 | ***0.18*** | ***0.17*** | ***0.23*** |
| Tenderness | 0.14 | ***0.30*** | ***0.28*** | ***0.38*** |
| Shear (14 d) | ***-0.16*** | ***-0.27*** | ***-0.31*** | ***-0.22*** |

[1]Bold and italicized items are significant (P<0.05)

- Correlations between % lipid and shear force at 2, 7, 14, and 21 day were –0.18, -0.20, -0.26, and –0.20 respectively (P<0.01 for all time points).
- The correlation between % lipid and sensory panel tenderness was 0.14 with a P-value of .054.

### Objective 2:

- No quality measurements differed amongst the three groups (always tender, always tough, aged) except for subjective firmness (2.80, 2.80, 3.40 respectively), % drip loss (1.24, 1.68, 2.09 respectively), and Minolta L* values (43.78, 46.68, 46.60 respectively).

Table 3. Biochemical attributes between different aging groups.

| | Tender (n=10) | Tough (n=10) | Aged (n=10) | SEM |
|---|---|---|---|---|
| Glycogen +Glucose+G-6-P (umol/g) | 20.61 [a] | 28.61 [b] | 29.42 [b] | 2.46 |
| Lactate (umol/g) | 77.86 [a] | 85.93 [b] | 87.16 [b] | 2.51 |
| Glycolytic Potential (umol/g) | 119.08 [a] | 143.16 [b] | 146.00 [b] | 6.91 |
| Hydroxyproline content (mg/g) | 4.38 [a] | 5.11 [b] | 4.97 [b] | 0.19 |
| Desmin Degradation (% change) | 30.08 | 18.99 | 14.70 | 9.08 |
| Sarcomere Length (microns) | 1.85 | 1.83 | 1.83 | 0.02 |

[ab] Means with different superscripts are different (P<0.05)

## Summary:

- Measures of pork quality within a single genetic line were quite variable.
- Ultimate pH was the most useful pH time point and most strongly correlated to measures of color and water holding capacity.
- Multiple samples were identified (~50% of the total population) that did not become more tender with post mortem aging.
- Glycolytic potential and collagen content were lower (P<0.05) in samples classified in the "always tender" group compared to the other two groups.
- Desmin degradation as an indicator of calpain system activity did not explain differences in post mortem tenderization.

## Implications:

- Typical measures of pork quality do not explain much variation in sensory properties in a commercial line of pigs.
- The unexpected differences in rate of post mortem tenderization are not explained by typical quality measures or by muscle structure differences such as collagen content and sarcomere length.
- Post mortem proteolysis of desmin does not ensure that the product will become more tender.