INFLUENCE OF POSTMORTEM AGING AND STORAGE ON PORK LOIN QUALITY

Matthew D. Schulte[1*], Elizabeth A. Zuber[1], Brian M. Patterson[1], Amanda C. Outhouse[1], Christine A. Fedler[2], Edward M. Steadham[1], Kenneth J. Prusa[2], Elisabeth Huff-Lonergan[1], and Steven M. Lonergan[1]

[1]Iowa State University, Department of Animal Science, Ames, Iowa 50011, United States of America;

[2]Iowa State University, Department of Food Science and Human Nutrition, Ames, Iowa 50011, United States of America;

*Corresponding author email: schulte1@iastate.edu

I. INTRODUCTION

It is well documented that aging fresh pork loins improves tenderness through proteolysis of myofibrillar, cytoskeletal, and intermediate filament proteins. However, the benefit of aging pork past 10-14 days (d) has not been well documented. Post aging freezing is used by some small-scale meat processors in the United States and the impact of that practice is not well understood. Star Probe (SP) and Warner Bratzler shear force (WBS) are two unique instrumental tenderness measurement devices [1]. The relationship between these tenderness evaluation methods is not well defined. The objective of this experiment were to document the aging response of fresh pork loins over 21 d, determine the relationship between different instrumental tenderness measurements (SP and WBS), and determine the effect of post aging freezing on fresh pork loin quality.

II. MATERIALS AND METHODS

Paired sides of fresh pork loins (n=20) were collected 1 d postmortem at a commercial pork processing facility. Criteria for inclusion in the study were a pH between 5.85 and 6.10 with a visual color score between 3 and 4. Eight loin chops (2.54 cm thick) containing only the longissimus muscle were fabricated from each loin. Four chops from each pair of loins were aged for 1, 8, 14 or 21 d and immediately evaluated (Fresh). Four adjacent chops (2.54 cm thick) were frozen post-aging for two weeks and then thawed for quality evaluation (Frozen). Loin side for each set of aging times (1 and 8 or 14 and 21 d) were randomly selected. At completion of aging, chops were evaluated to determine percent purge, Hunter L, a, and b value, pH, and color and marbling score [2]. Chops were then cooked to 68 °C and evaluated for cook loss. SP (kg) and WBS values (kg) were collected on separate, adjacent chops. Longissimus muscle (1 cm thick) from each loin were frozen and homogenized in liquid nitrogen at each aging period. Whole muscle samples were extracted using whole muscle solubilizing buffer (10mM sodium phosphate, pH 7.0 and 2% wt/vol sodium dodecyl sulfate). Abundance of intact desmin (55 kDa) in the whole muscle sample were determined using immunoblotting. Sample abundance was normalized by a reference sample on each gel. Quality data were analyzed using the mixed procedure of SAS version 9.4 with fixed effects of d aged and treatment (Fresh or Frozen) with a random effect of pig. Side was not significant ($P>0.05$) in any measurement. Desmin data were analyzed using the mixed procedure of SAS version 9.4 with fixed effects of d aged and carcass. Gel was not significant ($P>0.05$).

III. RESULTS AND DISCUSSION

Both SP and WBS values declined significantly ($P<0.01$) from 1 to 8 d aging but did not change after 8 d aging regardless of treatment. Fresh chop purge increased significantly ($P<0.01$) at each d of aging. Post aging freezing chop purge was significantly ($P<0.01$) greater in samples aged 1, 8 and 14 d but were not significantly different at 21 d aging. Post aging freezing resulted in significantly ($P<0.01$) lesser cook loss after 1 d aging but was not significantly different after 8 d aging. Fresh chop cook loss was significantly greater than post aging freezing chop cook loss at 14 ($P=0.03$) and 21 ($P<0.01$) d aging. Fresh chop L value increased significantly ($P<0.01$) from 1 to 8 d aging but did not change after 8 d aging regardless of treatment. Fresh

chop a value was significantly (P<0.01) lesser at d 1 than any other aging time point. Post aging freezing resulted in significantly (P<0.01) greater chop a value at 1 d aging but was not significantly different after 8 d aging. Fresh chop b value increased significantly (P<0.01) from 1 to 8 d aging but was not significantly different after 8 d aging. Post aging freezing resulted in significantly (P<0.01) greater chop b value at 1, 14, and 21 d aging. Post aging freezing had no significant effect on tenderness measurements, pH, color score, marbling score, or Hunter L value at any aging period. Across all aging periods, SP value was correlated (r= 0.85; P<0.01) with WBS values. The abundance of intact desmin in whole muscle samples decreased significantly (P<0.01) between 1, 8, and 14 (1.16, 0.63, and 0.50 respectively) d aging. Abundance of intact desmin in samples aged 21 d was not different compared with samples aged 14 d postmortem (0.51 and 0.50, respectively).

Table 1. Summary of effects of aging and post aging freezing on pork loin chop quality

Treatment	Fresh				Frozen				SEM
Days Aged	1	8	14	21	1	8	14	21	
SP (kg)	8.44^{a}	6.58^{b}	6.33^{b}	6.54^{b}	7.92^{a}	6.22^{b}	6.30^{b}	5.82^{b}	0.37
WBS (kg)	5.62^{a}	3.83^{bc}	3.62^{bc}	3.31^{cd}	6.19^{a}	3.36^{bcd}	4.30^{b}	2.53^{d}	0.34
Purge (%)	0.15^{f}	1.31^{e}	2.23^{cd}	2.93^{b}	1.81^{de}	2.56^{bc}	3.83^{a}	3.09^{b}	0.21
pH	5.88^{abc}	5.82^{c}	5.89^{abc}	5.86^{bc}	5.82^{c}	5.90^{abc}	5.96^{a}	5.93^{ab}	0.04
Color Score	3.4^{a}	3.0^{bc}	2.8^{cde}	2.7^{de}	3.1^{ab}	2.8^{cd}	2.7^{de}	2.5^{e}	0.11
Marbling Score	1.9^{a}	2.0^{a}	1.9^{a}	2.2^{a}	2.2^{a}	2.3^{a}	2.2^{a}	2.2^{a}	0.17
Cook Loss (%)	20.73^{ab}	18.25^{cd}	20.18^{b}	19.62^{bc}	21.98^{a}	18.41^{cd}	18.37^{cd}	16.88^{d}	0.64
Hunter L value	43.88^{d}	48.62^{c}	48.83^{bc}	50.03^{ab}	44.94^{d}	49.20^{bc}	49.17^{bc}	50.96^{a}	0.47
Hunter a value	11.96^{c}	13.66^{a}	13.92^{a}	13.73^{a}	13.13^{b}	13.86^{a}	13.78^{a}	14.00^{a}	0.18
Hunter b value	2.49^{d}	3.71^{b}	3.79^{b}	3.60^{bc}	3.40^{c}	3.86^{b}	4.29^{a}	4.59^{a}	0.13

* ^{a,b,c,d,e,f} Means with different superscripts within rows are significantly different (P<0.05).

IV. CONCLUSION

The results demonstrate that aging pork past 8 d postmortem did not improve SP or WBS values in pork loin chops. In general, SP and WBS values were consistent with protein degradation results. Furthermore, SP and WBS values are highly correlated instrumental tenderness measurements. The results show that post-aging freezing of samples does not significantly impact pork quality features of color, marbling, cook loss, and instrumental tenderness. Additionally, freezing pork at 1 d postmortem will not allow products to age so pork must also be aged.

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