COLOR STABILITY OF FRESH PORK CHOPS AND PALATABILITY TRAITS OF ENHANCED LOINS FROM IMMUNOCASTRATED BARROWS

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Abstract - The objective of this study was to evaluate color stability of fresh pork chops and enhanced loin quality from GnRF immunologically-castrated (IC) barrows (Improvest®) in comparison to surgically-castrated (SC) barrows. Treatments included barrows fed 0.55% SID lysine, and IC barrows fed 0.45%, 0.55% and 0.65% SID lysine for approximately 7 weeks prior to slaughter. Chops were collected from the sirloin end of Canadian back loins, placed onto trays, PVC overwrapped, and displayed under constant light for 7 days at 4°C for color stability evaluation. The remaining Canadian back loin was cut in half, and one half was enhanced. Chops were collected from each loin half and evaluated for sensory characteristics and tenderness (Warner-Bratzler Shear force and star probe). There were no differences in color stability of fresh loin chops between IC barrows and SC barrows. Similarly, there were no differences between IC males and barrows with regards to sensory characteristics, shear force, or star probe tenderness of the enhanced and non-enhanced loins. There was no interaction of treatment and enhancement for any trait measured. These data suggest immunocastration does not affect color stability of fresh pork chops or the quality of enhanced loins.

Key Words— Immunocastration, pork, quality, IC Barrow

I. INTRODUCTION

Immunocastration has been introduced globally and is becoming a widely accepted alternative to surgical castration. Through the use of Improvac®/Innosure®/Vivax® or Improvest® (Pfizer Animal Health), an anti-gonadotropin-releasing factor immunological product, producers world-wide have taken advantage of the increased feed efficiency, average daily gain, and improved carcass lean characteristics [1] of the entire male without the negative effects on sensory characteristics [2, 3] and overall pork quality [4]. However, no studies to date have compared the color stability, shelf life, or enhanced pork quality of IC barrows compared to surgical castrate barrows. Consumers view surface color of meat as one of the most important quality attributes when making purchasing decisions. Discoloration of meat, often associated with lipid oxidation and the development of off-flavors and odors [5], is viewed as a negative attribute. Therefore, the first objective of this study was to evaluate color stability of loin chops from IC barrows and surgically castrated (SC) barrows. Our hypothesis, however, was that immunocastration would not affect the color stability of fresh pork chops.

Enhancing pork is a common technology used to improve fresh pork. After enhancement, pork tends to be more tender, juicy, and flavorful than non-enhanced pork [6, 7]. Due to the prevalence of enhancements in pork, new technologies such as immunocastration must not negatively affect these products. Therefore, the second objective of this study was to evaluate palatability traits of enhanced and non-enhanced loins from IC barrows and SC barrows. Similar to fresh pork, it is hypothesized that immunocastration will not affect the quality of enhanced loins.

II. MATERIALS AND METHODS

Pigs of commercial breeding comparable to those used in industry settings were used in this study. Approximately 1000 pigs from a sow center farm were allotted to a wean-to-finish building. Treatments included SC barrows fed 0.55% SID lysine and IC barrows fed 0.45%, 0.55% and 0.65% SID lysine for approximately 7 weeks prior to slaughter. Improvest®-

immunized barrows received the first injection at ~4 months of age (16 weeks) and the second injection 4 weeks (20 weeks) subsequently. Pigs were transported to a commercial facility and harvested under inspection at an approximate ending live weight of 120 kg.

Carcasses from the 2 pigs closest to the pen mean (2 pigs per pen; 7 pens per treatment group) were shipped to University of Illinois Meat Science Laboratory, fabricated, and Canadian back loins (NAMP #414) obtained. Two 2.5 cm chops were collected from the sirloin end, placed on trays, PVC overwrapped, and displayed under constant light at 4°C for 7 days. On days 1, 3, 5, and 7, a trained, five-person panel using a 10 cm scale for percent discoloration with 0 representing no discoloration and 10 representing 100% discoloration, and overall color with 0 representing color score 1 (very pale), 5 representing color score 3 (average), and 10 representing 6 (very dark) according to NPPC color standards [8]. At the same times, chops were evaluated for objective color using the Minolta CR-400, (Minolta Camera Company, Osaka, Japan); D65 light source and 0° observer) to obtain L*, a*, and b* values with the Hunter Lab Miniscan XE for discoloration using the difference in reflectance at 630 and 580 nm methods similar to Holmer *et al* [9]. One reading was recorded on the same chop each day for objective color.

After these two chops were collected, loins were paired by pen, cut in half, and each half was assigned to either control (non-enhanced) or enhanced. Each half of the loin (sirloin end and blade end) was represented for each pen which served as the experimental unit. Enhanced loin halves were pumped to 110% of green weight using a 3.5% salt and 3.5% phosphate solution. Loins were weighed prior to and after enhancing to establish the pump uptake of each loin. Loins were, vacuum-packaged, allowed to equilibrate at 4°C for 7 days and cut into chops for analysis.

Chops were cooked to an internal temperature of 70°C on a Faberware open hearth grill. Temperature was monitored using cooper constantan thermocouples and a recording thermometer (Digi-Sense Cole-Parmer, Barrington, IL). A six-person trained sensory panel evaluated the enhanced and control chops for tenderness, juiciness, and off-flavor on a 15 cm unstructured scale. A score of 0 indicated a very tough, dry chop with no off-flavor. A score of 15 indicated a very tender, juicy chop with intense off-flavor.

For analysis of Warner-Bratzler shear force and tenderness with star probe, chops were cooked using the procedure above and weighed before and after cooking to determine cook loss. After cooling to 25°C, four 1.25 cm cores were removed parallel to the orientation of the muscle fibers sheared using a Texture Analyzer TA.HD Plus (Texture Technologies Corp., Scarsdale NY/Stable Microsystems, Godalming, UK) with a blade speed of 10 mm/sec and a load cell capacity of 100 kg. Shear force was determined on each core and averaged. A star-shaped probe was lowered to the surface of another cooled chop. The probe was pushed into the chop until the chop was compressed to 20% of its original thickness three times at three different locations and the values were averaged

Data were analyzed using the MIXED models procedure in SAS (SAS Institute Inc., Cary, NC). The results for the two pigs from each pen were averaged and pen served as the experimental unit for all traits measured. Color stability over time was analyzed as repeated measures with using an unstructured covariate structure. Treatment, storage time, and their interaction served as the fixed effects of the model. For enhancement, data were analyzed as a split plot design where treatment was used as the whole plot, group (enhanced loin or control) was used as sub-plot, and their interaction served as the fixed effects of the model. Means were separated using the PDIFF option employing a Tukey adjustment for multiple comparisons. Differences were deemed significant at $P < 0.05$.

III. RESULTS AND DISCUSSION

Fresh Pork Chops

Discoloration of chops increased with display time. However, there were no differences between treatments or interactions between treatments and day with regards to discoloration. Chops of all treatments discolored in a similar fashion with display time (Figure 1) suggesting immunocastration does not alter discoloration. Furthermore, after a 7 day display time, discoloration was minimal (7-10%). This suggests that chops were within an acceptable range of consumer acceptance which was found to diminish at 20% metmyoglobin (brown pigment) concentration [10]. Discoloration corresponds to the difference in reflectance at wavelengths of 630 and 580 wavelength measured by the Hunter Lab Miniscan XE. This trait was also not affected by treatment with no significant interaction between display time and treatment. R630-R580 values changed over time, but not in an obvious trend (data not shown). This is to be expected as panelists detected minimal discoloration overall.

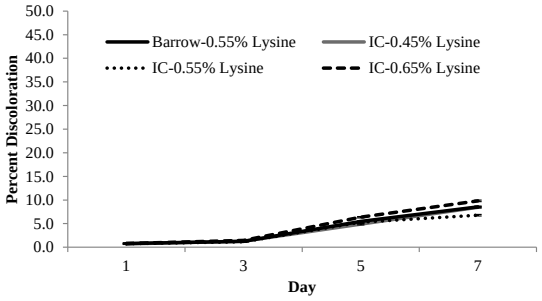


Figure 1. Discoloration of fresh pork chops

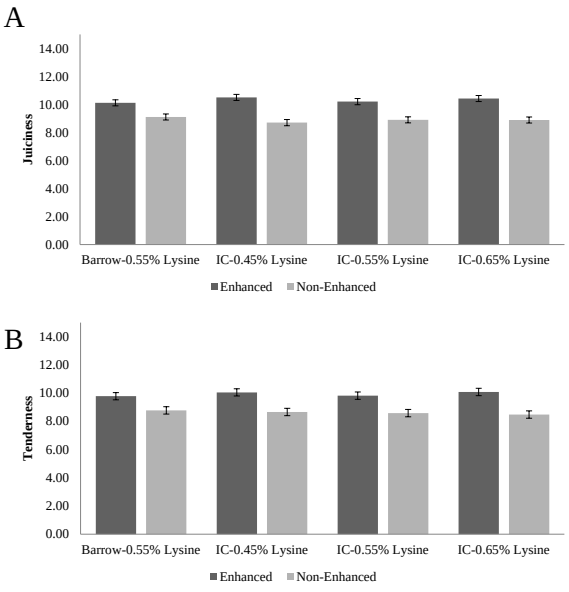
For overall subjective color, there was a significant interaction of treatment and display time ($P < 0.05$). Over time, color became darker but not all treatments darkened in the same fashion. In general, IC barrows fed 0.65% SID lysine had the darkest color while SC barrows had the lightest ($P < 0.05$). Overall, color scores ranged from 5 to 6 corresponding to a 3 or 4 on the NPPC scale [8] indicating all chops were of acceptable color (data not shown).

Similarly, display time did affect ($P<0.05$) Minolta values (data not shown). L* values decreased from days 1 to 5 indicating chops got darker over time. On day 7, L* values increased for all treatments, but for all days chops fell in the normal L* range of 43-50 [11]. Treatment did not affect a* values. However, treatment did affect the b* values ($P < 0.05$) with barrow recording the highest value and 0.45% SID lysine IC barrows recording the lowest (data not shown). There was no significant interaction between treatment and display time for Minolta readings.

Enhanced Loin

Treatment did not affect pump uptake. While green and pumped weights of IC barrows fed 0.55 and 0.65% SID lysine were greater ($P<0.05$) than green and pumped weights of SC barrows and IC barrows fed 0.45% SID lysine, there was no difference in pump uptake between treatments.

Treatment did not affect sensory characteristics (Figures 1.2-1.4) of enhanced or non-enhanced chops. However, as expected, enhanced chops were more tender, juicier, but had more off-flavor than non-enhanced chops. There were no significant interactions of treatment and enhancement for any sensory attributes.



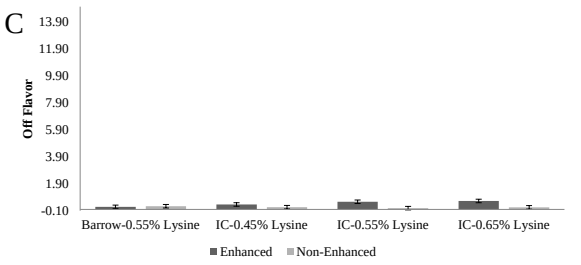


Figure 2. Sensory panel ratings of juiciness (A), tenderness (B) and off-flavor (C) in enhanced and non-enhanced pork chops.

Treatment did not affect cook loss, shear force, or star probe tenderness. However enhanced chops saw a 20.6% reduction in cook loss, 0.61 kg lower shear force value, and a 0.76 kg lower star probe force value when compared to non-enhanced chops ($P<0.05$). There were no significant interactions between enhancement and treatment.

IV. CONCLUSION

Overall, immunocastration does not affect loin quality. Other authors [3, 12] have reported similar quality between SC barrows and IC barrows for fresh, non-enhanced loins. We further conclude that immunocastration does not affect color stability of fresh loin chops or the sensory properties of enhanced loins. Therefore, pork from IC barrows can be used and treated the same as that of SC barrows.

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