COMMON FACTOR ANALYSIS OF PORK LOIN QUALITY FROM CHOPS COOKED TO 63°C

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I. INTRODUCTION

Pork quality continues to be a top priority for the global pork industry. To meet demands, genetics companies and processors must know which traits are most relevant in determining overall eating satisfaction for the more discriminating consumers. Previous research by Fields *et al.* [1] demonstrated that three factors contributed to common variation in objective and subjective pork quality traits; 1) pH, 2) color, and 3) marbling. These three factors accounted for 63% of the common variation in the loin quality traits. Since this work was published the United States Department of Agriculture has reduced the recommended internal cooking temperature of fresh pork from 70°C to 63°C. The objective of this trial was to determine if the factors previously identified contributing to the common variation in pork loin quality changed at an internal cooking temperature of 63°C using pork loins from pigs sired by boars from four different unrelated commercial Duroc lines.

II. MATERIALS AND METHODS

Pigs from four unrelated commercial Duroc sire lines were harvested at a commercial pork processing plant in the United States on four different harvest dates. Hot carcass weight, backfat, and loin depth was recorded for each carcass using an optical probe. Boneless loins were evaluated at approximately 22 h post-mortem for pH, Minolta L*, a*, and b* and were scored using National Pork Board standards for subjective color (1=pale to 6=dark purple), marbling (1=devoid to 10=abundant) and firmness (1=soft to 5=very firm). Boneless loins from a total of 256 pigs were vacuum packaged and transported to the University of Illinois Meats Science Laboratory. Loins were aged at 4°C for 16 days. When bags were opened, pH and purge loss were measured. Three 2.54 cm thick center cut pork chops were cut from each loin, packaged, and frozen for analysis at a later date. Chops were thawed at 22°C for 24 h, weighed, and then cooked on a Faberware® open hearth grill to 63°C. The chop was allowed to cool at room temperature and then re-weighed to determine cook loss percentage. Four 1.25 cm cores were removed from the chop running parallel to the muscle fibers to determine shear force. Meat cores were sliced using a Texture Analyzer TA.HD with a Warner-Bratzler shear head. For each loin chop the average shear force of the four cores was calculated. Proximate analyses were conducted using the second loin chop to determine moisture and intramuscular fat percentages. Six trained panelists evaluated meat samples from a third loin chop for tenderness, juiciness, and pork flavor intensity using a 15 cm unstructured line scale for each sensory attribute. Frozen loin chops were thawed for 24 h at 4°C and then cooked to an internal temperature of 63°C and were allowed to rest for three minutes before being cut into 1 cm cubes and served. The average score for each sensory trait across panelists was calculated for each loin.

Common Factor Analysis is a multivariate statistical procedure for reducing the number of correlated traits down to a more manageable number of traits that share a common source of variation with one or more loading factors. The PROC FACTOR procedure in SAS 9.4 using Maximum Likelihood methodology and the MAXIVAR rotation method as options was used to analyze data. Initial analyses indicated carcass weight, backfat, loin depth and sensory traits of tenderness, juiciness, and flavor intensity were lowly correlated with the loading factors and were removed from the final statistical analysis. For each factor, the three traits with the highest correlations greater than the absolute value of 0.50 were deemed important contributors to the overall common variation.

III. RESULTS AND DISCUSSION

Table 1 contains the three loading factors and the correlations with the traits included in the final statistical model. The three traits most highly correlated with each factor are highlighted with a bold font.

Table 1 Rotated Factor Pattern

Trait	Factor 1	Factor 2	Factor 3	Commonality
pH 22 h	**0.82**	-0.01	-0.04	0.68
pH after 16-day aging	**0.85**	-0.04	0.12	0.74
Purge loss %	**-0.53**	0.00	-0.11	0.30
Marbling score	0.39	**0.54**	0.23	0.49
Moisture %	0.14	**-0.83**	-0.21	0.82
IMF%	-0.06	**0.97**	0.07	0.99
Minolta L*	-0.31	0.19	**0.64**	0.68
Minolta a*	-0.37	-0.02	**0.70**	0.64
Minolta b	0.05	0.22	**0.70**	0.54
Color score	0.37	0.05	-0.09	0.25

The three most highly correlated traits with the first loading factor were pH 22 h, pH after 16 days of aging and purge loss percentage. Purge loss is moderately correlated in these data with pH 22 h (-.42) and pH after aging (-.48). Thus, the first loading factor can be named, “pH”. The first loading factor in this trial agrees with the first loading factor reported by Fields *et al.* [1]. Subjective marbling score, moisture and intra-muscular fat percentage are most highly correlated with the second loading factor. Minolta L*, a* and b* were traits highly correlated with the third loading factor. Therefore, the second loading factor can be designated as “marbling” and the third factor can be designated as “color”. In the work published by Fields *et al.* [1] the loading factors for color and marbling were in the reverse order to those presented in this study. The three primary factors identified in this study accounted for 59 % of the common variation in the remaining traits.

IV. CONCLUSION

Results from this trial indicate that pH is the most important factor that drives overall pork quality. Color and marbling are also important contributors to overall pork quality but to a lesser degree. Furthermore, these data agree with previous work by Lonergan, *et al.* [2] and Ibarburu *et al.* [3] that concluded that pH significantly impacts pork quality and has a greater influence on sensory quality than does marbling. Therefore, genetics companies should focus on improvement of these traits, as well as direct measurements of eating satisfaction in order to improve consumer satisfaction and increase demand for pork. The level of significance of color and marbling varies between this and the previous study. It is theorized that the key difference is the degree of doneness, although inherent genetic differences in the two study groups of loins may also be a factor.

REFERENCES

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