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Relationships between Carcass Characteristics of Commercial Pork Breeds

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Introduction

The redness of meat is the consequence of high amounts of myoglobin and capillary content in meat tissue and contributes to the greater oxidative capacity of red muscles compared with white muscles. Studies have demonstrated the high co-relationship between the speed of muscle contraction and myosin-ATPase activity. For the general purposes, muscle fibers are typed in three ways: histochemical staining for myosin ATPase, identification of myosin heavy chain isoforms, and biochemical identification of metabolic enzymes related to muscle contraction. Primarily, mysosin heavy chain isoforms I, IIa and IIx corresponds muscle fiber types I, IIA, and IIB. Muscle fiber type is a breed specific traits and has a effect on meat quality due to its relation to postmortem glycolytic rate, proteolytic rate and water-holding capacity (Eggert *et al.*, 2002). The current study was conducted to identify relationship between myosin heavy chain I to objective color dimensions.

Materials and Methods

1. Animal, Sampling and Measurement

Thirty market-weighted male pigs (10 Landrace, 10 Yorkshire, and 10 Korean native pig) were sampled from the NLRI breeding program. Pigs were conventionally slaughtered, and placed in a 1℃ chiller until the following day. pH, temperature, WB-shear force, and meat color were determined similar to those described by Hwang *et al.* (2004). Relative composition of MyHC-I isoform in myofibril was determined by applying an indirect enzyme-linked immunosorbent assay (ELISA). Longissimus muscle tissue was biopsied

Table 1. Least square mean and significance level of carcass traits, objective meat quality and changes in concentration of free amino acids from death to 7 d postmortem as a function of breed and ageing time

	Breed		Ageing			Model terms	
	Landrace	Yorkshire	1	7	Av. Se	Breed	Ageing
pH at 4 h pm	6.2	6.2	na	na	0.07	ns	
Temperature at 4 h pm (℃)	22.1	21.1	na	na	0.09	ns	
Temperature at pH 6.2 (℃)	21.5	20.4	na	na	3.05	ns	
Sarcomere length (μm)	1.74	1.74	na	na	0.02	ns	
WB-Shear force (kg)	6.25	7.50	8.04	5.71	0.26	***	***
Hunter L*	45.02	42.34	41.95	45.41	0.91	*	*
df[a]						1/18 (1/37)	1/18 (1/37_

na-Not applicable, ns- $P>0.05$, $^{*}P< 0.05$, $^{**}P<0.01$, $^{***}P<0.001$.
a -Numerator/denominator degree of freedom (where ageing term was applicable).

during bleeding, immediately frozen in liquid nitrogen, and stored at -70℃ until analysis. Crude extracts were made by stirring 200 mg of tissue powder in 1.4 mL extraction buffer (0.3 M KCl, 0.1 M KH_2PO_4, 0.05 M K_2HPO_4, 0.04 M EDTA, pH 6.5, 1 mM DTT) for 15 min on ice. The homogenate was centrifuged at 10,000 × g for 20 min at 4℃, and the supernatant was diluted in two-fold with glycerol to a final concentration of 50%, and stored at -70℃ until used. Primary and secondary antibodies were human MyHC-I monoclonal antibody(F36.5B9, 2C8, isotype mouse IgG2a, Biocytex biotechnology) and rabbit anti-mouse IgG (conjugated with alkaline phosphatase, Bethyl, Lab. Inc). *p*-nitro-phenyl phosphate solution (Sigma, SL, USA) was used for color development and absorbance was measured at 405 nm using a plate reader (MicroScreener LB 9260, EG & E BERTHOLD, Germany). Relative percentage of MyHC-I was calculated against a standard curve of *m. masseter* tissue.

Results and Discussion

Table 1 and Fig. 1 show carcass traits and relationship between MyHC-I and objective meat color dimensions. Loin temperature at pH 6.2 had simple correlation coefficients (r) of -0.9 and -0.93 with pH at 2 and 4 h; respectively, and of 0.4 and 0.5 with temperature

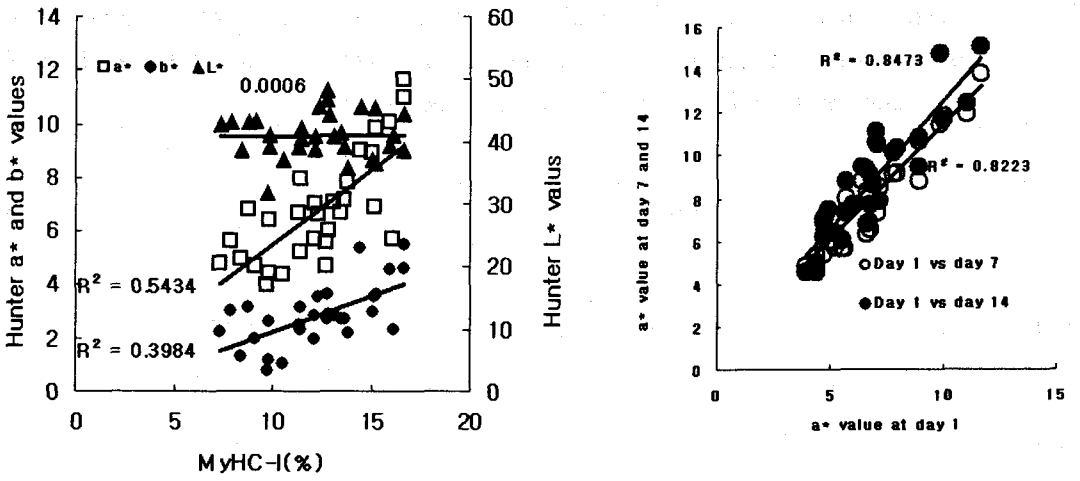

Fig. 1. Relationship between MyHC-I and objective color dimension(left) and Hunter a* values between day 1 and days 7 and 14.

at 2 and 4 h , respectively. The pH/temperature and sarcomere length indicated that there was no biological and physical muscle shortenings for the pigs involved in the current study. All breeds showed a similar postmortem metabolic rate, but landrace breed had a significantly ($p<0.05$) higher WB-shear force than Yorkshire. In the co-relations between myosin heavy chain I and Hunter L*, a* and b*, coefficients of determinant (r^2) were 0.0, 0.54, 0.40, respectively. Given that mysosin heavy chain isoforms I, IIa and IIx corresponds muscle fiber types I, IIA, and IIB and redness of meat is crossly linked to high oxidative fiber composition, the negligible relationship between whiteness color dimension (eg. Hunter L*) and myosin heavy chanin isoform I was of interest in the current study. On the other hand, the high linkage between the isoform and red dimension (eg. Hunter a*) evidenced the previous reports. As the pH/temperature window influences protein denaturation including enzymes taking part in oxidation and reduction process of color development, it was of interest to see if carcass temperature at pH 6.2 has a significant effect on color stability during ageing. However, there was no noticeable relationship for the current dataset used for analysis (data not shown). For he current dataset, Hunter a* value at day 1 had higher relationships with that at both day 7 and 14, implying that redness was relative stable over the storage periods and emphasizing the importance of management of initial meat color which is largely affected by animal management prior to slaughter.

Summary

The current study was conducted to identify relationship between myosin heavy chain I

to objective color dimensions. Myosin heavy chain I isoform showed coefficients of determinant (r^2) of 0.54 and 0.40 for Hunter a* and b* values. For he current dataset, Hunter a* value at day 1 had higher relationships with that at both day 7 and 14, emphasizing the importance of initial meat color which is largely affected by animal management prior to slaughter.

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