FIBRE TYPE OF KOREAN NATIVE PORK AND ITS EFFECTS ON POST-MORTEM PROTEOLYSIS

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Introduction

The reddish feature of Korean native pork is a favorable characteristic to Korean consumers, and likely related to fibre composition. Fibre type is a significant component affecting meat quality due to its relation to postmortem glycolytic rate, proteolytic rate and water-holding capacity (Eggert *et al.*, 2002). pH/temperature window during rigor development has a significant effect on meat quality though its effect on proteolysis, shortening and protein denaturation (Hwang *et al.*, 2004). As Korean native black pig (KNBP) has two carcass traits of red meat colour and small carcass size of which effect on pH/temperature window is great, the fibre type of KNBP has great effect on postmortem proteolysis and meat quality. The current study was conducted to characterize fibre type of Korean native black pig (KNBP) and its relation to glycolysis, proteolysis, and objective meat quality with reference to Landrace.

Materials and Methods

Twenty market-weighted male pigs (10 landrace, 118 kg, and 10 KNBP, 72 kg) were sampled from the NLRI breeding program. The pigs were assigned to a 2 x 3 factorial which was composed of two chilling regimes (-3 and 5°C) and three ageing times (1, 7, and 14 d at 1°C). Pigs were conventionally slaughtered, and placed in a 1°C chiller until the following day. pH, temperature, WB-shear force, and meat colour 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) following Picard *et al.*, (1994). Longissimus muscle tissue was biopsied during bleeding, immediately frozen in liquid nitrogen, and stored at –70°C until analysis. 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*-nitrophenyl phosphate solution (Sigma, SL, USA) was used for colour development and absorbance was measured at 405 nm using a plate reader (MicroScreener LB 9260, EG and E BERTHOLD, Germany). Relative percentage of MyHC-I was calculated against a standard curve of *m. masseter* tissue. Postmortem proteolytic rate was quantified by a tricine-SDS-PAGE, and peptides were identified by a LC/MS/MS procedure described by Hwang *et al.*, (2005). For relative quantification, a horse myosin peptide cocktail (2.5 – 16.9 kDa, Amersham Biosciences) was run in triplicate, and changes in relative percentage of proteolytic products during ageing were calculated against 16.9 kDa peptide.

Results and Discussion

Table 1 and Figure 1 describe fibre composition, objective meat quality and rate of proteolysis during chiller ageing. The results demonstrated that KNBP longissimus muscle had a higher level in hunter a* value (red dimension), and that was related to a higher proportion of slow myosin heavy chain (MyHC-I). Given the result of an early study (Depreux, *et al.*, 2002) which reported that MyHC-I was negatively related to carcass weight, we could not exclude that the lighter carcass weight of KNBP, with similar age, was a possible factor for the higher proportion of the slow fibre type. However, our previous study (Hwang *et al.*, 2004) found that old and heavy KNBP (ca. 100 kg and 13 month old) also showed a similar colour characteristic. The results collectively implied that genetic components were involved in the distinct colour feature of KNBP. It has been well documented that carcass temperature of 10-15°C during rigor development could minimize muscle shortening and maximize proteolysis (Hwang *et al.*, 2003). Based on longissimus temperature at pH 6.2, pH/temperature decline of KNBP during rigor development was greatly favorable for resulting in tender meat (Table 1). This could be a consequence of slower glycolytic rate due to the higher proportion of slow myosin heavy chain (Bowker *et al.*, (2004), and faster chilling rate for the small carcasses. As previous studies demonstrated, this was reflected by a fast appearance of proteolytic peptides (Figure 1) but the presence of which was not significant on WB-shear force (Table 1). While bearing this fact in mind the proteolytic rate is significantly faster in white type muscle, thus one might expect a faster proteolytic rate for Landrace due to the higher frequency of white type fibres (Bowker *et al.*, 2004). However, KNBP showed a significantly faster degradation rate for some proteins (ca. creatine kinase, GAPDH, myosin light chain, titin and troponin I).

Table 1: Differences in objective meat qualities and postmortem proteolysis between landrace and Korean native black pig(KNBP).

	Breed		Av.se	F value		df[d]
	Landrace	KNBP		Breed	Ageing	
pH at 3 h	6.3	6.5	0.06	6.12*		1(1)/18
Temperature at 3 h	26.0	23.1	0.87	5.77*		1(1)/18
Temperature at pH 6.2	21.5	11.4	2.52	7.93*		
pH at 24 h	2.3	3.0	0.87	0.3		
Temperature at 24	5.5	5.6	0.05	2.58		
MyHC-I (%)	11.3	14.2	0.71	7.91*		1(1)/18
WB-shear force (kg)	5.8	5.4	0.22	2.77	52.0***	1(2)/56
Hunter a*	6.8	10.2	0.32	57.27***	7.12**	1(2)/56
Hunter L*	45.9	42.1	0.64	17.44***	11.47***	1(2)/56
Band A (%)[f]	157.7	133.4	9.17	3.5		1(1)/18
Band B (%)[f]	11.2	12.6	0.71	1.85	30.55***	1(2)/56
Band C (%)[f]	8.2	10.2	0.51	7.37**	26.64***	1(2)/56
Band D (%)[f]	8.8	10.5	0.47	6.96*	17.86***	1(2)/56
Band E (%)[f]	9.4	11.4	0.74	3.87	13.88***	1(2)/56
Band F (%)[f]	7.6	8.9	0.86	1.24	19.54***	1(2)/56
Peak A	7.1	6.8	0.35	0.39	203.5***	1(2)/17

*P<0.05, **P<0.01, ***P<0.001, [d] Numerator/denominator degree of freedom for breed (ageing), [f] Relative percentage of 16.9 kDa horse myosin peptide.

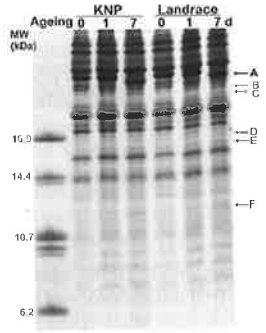

Figure 1: Changes in small molecular proteins during chiller ageing for Landrace and Korean native black pig(KNP), and 2DE-chromathgraphic profile (cation exchange, SCX, and reverse phase, RP) during ageing. Band A: Adenylate Kinase, Troponin I fast skeletal muscle, Glyceraldehyde-3-phosphate dehydrogenase; B: Creatine kinase, glyceraldehyde-3-phosphate dehydrogenase, Triosephosphate isomerase; C: Creatine kinase, GAPDH, Myosin light; D: Titin, Superoxide dismutase 1, GAPDH, Troponin I; E: Myosin light chain 1, Glyceraldehyde-3-phosphate dehydrogenase, Cytochrome c oxidase subunit IV isoform 1, Creatine kinase; F: Myosin light chain 2, myozenin 1, Creatine kinase, Glyceraldehyde-3-phosphate dehydrogenase , KIAA0613 protein.

Conclusions

The more a reddish colour of KNBP was related to higher frequency of slower fibre. KNBP showed more favorable pH/temperature profile during rigor development and was coincided with a faster proteolytic rate.

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