MEAT COLOR DETERIORATION CHARACTERISITIC IN MAJOR PORCINE MUSCLES DURING COLD STORAGE

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Abstract— **The relationship of myoblogin(Mb) cocentration, intramuscular fat content to color deterioration and lipid oxidation in four porcine muscles (LD;*Longissimus dorsi*, PM;*Psoas major*(PM), BF;*Biceps femoris*, SM; *Semimemebransus*) was investigated. The muscles were obtained from 12 porcine carcasses at 24 hours postmortem. Ground pork patty cores were prepared and pakaged with oxygen permeable polyethylene bag, and stored at 4 °C for 7days to measure meat color (CIE L*, a*, b*), percentage of DeoxyMb (Myoglobin), OxyMb and MetMb, thiobarituric acid reactive substance (TBARS) value, Mb concentration, pH and fat content. Result showed that PM samples of porcine muscles were significantly ($p<0.05$) higher CIE L a*-value and lower CIE L*-value compared to other muscles at 7 days of cold storage. No significant differences in muscls fat and Mb content were found among muscles samples during cold storage. However, MetMb percentage of PM sample was significantly ($p<0.05$) higher than those of LD, BF, SM after 7 days of cold storage. Results suggested that rapid color deterioration of pork tenderloin during cold storage compared to other pork cuts might be due to higher Mb concentration. Also data suggested that MetMb formation might be not affected by intramuscular fat content of pork during 7 days of cold storage.**

Key words—**Meat color oxidation, porcine major muscles, myoglobin oxiation, lipid oxidation**

I. INTRODUCTION

The fresh meat color is considered to be the most important meat quality attribute for consumers. Accoreding to on report, discoloration of surface meat in retail beef leads to revenue losses to the ture of around 15% in the U.S. meat industry(Smith and others 2000). The research trials were carried out to indentify the number of biochemical and physical factors affecting color and color stability.Meat color is influenced by many factors such as the concentration of heam pigment, Mb chemical state and the physical characteristics of the muscle.The Mb comineds with oxygne the form ferrous oxymyoglobin (OxyMb), which is bright red in color presumed by consumers to indicate freshness. During storage-life, the rate myoglobin oxidation accumulation onto surface of fresh meat is governed by many intrinsic factors and extrinsic factors or by a combination of these factors(Renerre 1990). According to Jeong et al(2009), differences in Mb oxidation rate vary depending on the muscle type and rapid discoloration in PM muscle of Hanwoo cattle muscle. The obfective of this study was to investigate the factors responsible for discoloration of 4 muscles of porcine meat stroag-life.

II. MATERIALS AND METHODS

Commercial 8 carcass muscles were selected randomly at 24h postmortem, and the 4 major muscles were used to make steaks (3 cm thickness). The steaks of each muscles were packaged in a polyethylene bag, and samples were subjected to *longisimuss dorsi*(LD), *Psoas major*(PM), *Semimemeransus*(SM), *Bicep femoris*(BF). All samples were stored at 4°C for 7 days to measured meat color CIE(L*,a*,b*), percentage of Mb chemistry froms, thiobabituric acid reactive substance(TBARS), pH, Mb concetration and fat content.

Meat color (CIE L*a*b*) was measured by using a Minolta Chromameter (Minolta CR 300; Tokyo, Japan). Seven random readings were made from the surface of samples. Mb concentration was measured by the method Warriss(1979) with modification. The Intramusceular fat content was using the procedure of Folch et al(1957). Myoglobin was extracted from meat samples with phosphate buffer of pH 6.8. Samples were homogenized, centrifuged and filtered to obtain the absorbance of the resulting supernatant solution at 572, 565, 545, and 525 nm, respectively. Lipid oxidation was measured by TBARS value.TBARS was measured by the method of Buege and Aust (1978) with modification.

III. RESULTS AND DISCUSSION

Results showed that the meat color deterioration characteristic in porcine muscles. Generally, L*-value of muscle foods is changing during cold storage. During cold storage periods, L*-value of *M. Psoas major*(PM) was significantly($p<0.05$) lower than *M. Bicep femoris*(BF), *M. Longissimus dorsi*(LD) and *M. Semiemebranosus* (SM). Muscles from BF and LD on porcine increased in lightness after 1 day of storage (Table 1). The other side, the a*-values of PM was significantly($p<0.05$) higher compared to BF, LD and SM. The redness of porcine muscles (BF, LD, PM) decreased with an increase of storage time. In other words, the BF, LD, PM of porcine decreased a*-value at 7 days of cold storage (Table 1). No significnt($p>0.05$) differences in redness were observed in SM muscle at 7 day of cold sotrage. Myoglobin chemistry form was related to colormeter measures value in porcine muscles. Metmyoglobin on Mb chemistry form was appeared that the amount of myoglobin oxidation accumulated on the surface of muscle. MetMb formation was related to lipid oxidation in fresh muscle foods. No significant difference in muscle TBARS values were found in this study. Also, No significant differences in curde fat and Mb content were ovserved among porcine 4 muscles. However, MetMb percentage of PM sample was significantly ($p<0.05$) higher than those of LD, BF and SM after 7 days of cold storage. TBARS values in porcine muscles were increased with storage periods and TBARS values of BF was significantly higher than LD, PM and SM. pH was increased with storage periods and LD was significantly higher than others muscles. On the other hand, pH of PM was significantly low than other muscles at 7 days of cold storage. Results suggested that low pH was not related with MetMb percentage and higher MB concentration. Also data suggested that MetMb formation might be not affected by intramusclar fat content of pork during 7 days of cold storage.

Table 1. Changes in meat color and Mb chemistry of porcine muscles during cold storage.

Treatment		Storage(days)			
		1	3	5	7
L*	BF[1]	52.63 ± 1.71^{Ac}	53.62 ± 2.37^{Abc}	55.18 ± 1.44^{Aab}	55.68 ± 1.31^{Aa}
	LD	49.01 ± 2.38^{Bb}	53.44 ± 3.03^{Aa}	54.85 ± 1.49^{Aa}	55.15 ± 1.11^{Aa}
	PM	47.69 ± 2.39^{B}	48.41 ± 1.83^{B}	49.15 ± 1.33^{B}	48.98 ± 2.03^{B}
	SM	53.58 ± 1.59^{A}	54.47 ± 2.24^{A}	55.76 ± 1.59^{A}	54.08 ± 2.28^{A}
a*	BF	9.81 ± 2.29^{B}	9.70 ± 2.09^{B}	9.17 ± 1.99^{B}	8.1 ± 1.57^{B}
	LD	6.6 ± 1.26^{Cb}	8.00 ± 1.24^{Ba}	7.36 ± 0.78^{Cab}	6.88 ± 0.89^{Cab}
	PM	14.99 ± 1.57^{Aa}	13.42 ± 1.45^{Ab}	12.07 ± 1.02^{Abc}	11.3 ± 1.02^{Ac}
	SM	8.11 ± 1.94^{BC}	8.25 ± 1.69^{B}	7.99 ± 0.85^{BC}	8.57 ± 0.82^{B}
b*	BF	7.12 ± 1.43^{A}	7.27 ± 1.44^{AB}	8.18 ± 1.61^{A}	8.27 ± 1.74^{A}
	LD	2.98 ± 0.53^{Bb}	6.35 ± 0.83^{Bab}	6.93 ± 0.86^{Ba}	6.89 ± 0.93^{Bab}
	PM	5.61 ± 0.78^{Ab}	8.05 ± 0.62^{Aa}	7.66 ± 0.83^{ABa}	7.77 ± 0.74^{Aba}
	SM	6.00 ± 2.21^{Ab}	6.35 ± 2.05^{Bb}	7.27 ± 0.93^{ABab}	8.43 ± 0.94^{Aa}
MetMb	BF	4.96 ± 3.08^{Abd}	10.50 ± 1.94^{Bc}	13.53 ± 0.65^{Bb}	21.83 ± 3.39^{Ba}
	LD	4.57 ± 2.41^{Bc}	13.36 ± 2.36^{Ab}	15.61 ± 2.49^{Aab}	17.37 ± 3.53^{Ca}
	PM	8.09 ± 3.37^{Ad}	11.51 ± 2.3^{Abc}	14.91 ± 2.31^{ABb}	28.03 ± 2.36^{Aa}
	SM	7.89 ± 1.21^{ABc}	12.12 ± 2.84^{ABb}	10.21 ± 0.75^{Cbc}	19.70 ± 3.01^{BCa}

Values are the means ± SD.
[1] BF: *Bicep femoris,* LD: *Longissimus dorsi*, PM: *Psoas major*, SM:*Semimembranosus.*
[a,b,c] Means in the same row with different letters are not significantly different($p<0.05$).
[A,B,C] Meas in the same column with different letter are not significantly different ($p<0.05$).

Tabel 2. Changes in lipid oxidation and p of porcine muscles for 7days of cold storage.

Treatment		Storage(days)			
		1	3	5	7
TBARS	BF[1]	0.11 ± 0.01^{BCc}	0.15 ± 0.03^{Bb}	0.14 ± 0.04^{Abc}	0.27 ± 0.03^{Aa}
	LD	0.17 ± 0.02^{Ab}	0.13 ± 0.01^{Cc}	0.17 ± 0.02^{Ab}	0.20 ± 0.02^{Ba}
	PM	0.13 ± 0.02^{Bd}	0.25 ± 0.02^{Aa}	0.17 ± 0.03^{Ac}	0.22 ± 0.02^{Bb}

	SM	0.10±0.01^{Cc}	0.15±0.02^{BCb}	0.16±0.03^{Ab}	0.22±0.03^{Ba}
pH	**BF**	5.54±0.01^{Bb}	5.53±0.04^{ABb}	5.52±0.06^{Ab}	5.6±0.05^{Aba}
	LD	5.45±0.03^{Cb}	5.47±0.02^{Bb}	5.45±0.04^{Bb}	5.54±0.03^{Ca}
	PM	5.46±0.03^{Cc}	5.51±0.03^{Abc}	5.54±0.07^{Ab}	5.63±0.05^{Aa}
	SM	5.63±0.06^{Aa}	5.52±0.07^{Ab}	5.55±0.03^{Ab}	5.56±0.06^{BCb}

Values are the means ± SD.
[1] BF: *Bicep femoris,* LD: *Longissimus dorsi*, PM: *Psoas major*, SM:*Semimembranosus.*
^{a,b,c,d} Means in the same row with different letters are not significantly different($p<0.05$).
^{A,B,C} Meas in the same column with different letter are not significantly different ($p<0.05$).

Tabel 3.The contents of intramuscular fat and myoglobin content in porcine muscles.

Item	**Treatment (muscle type)**			
	BF	**LD**	**PM**	**SM**
Crude fat	5.35±2.20	3.90±1.41	4.09±1.63	5.27±1.74
Mb concentration	1.20±0.33^{B}	1.03±0.31^{B}	1.62±0.19^{A}	1.20±0.26^{B}

Values are the means ± SD.
[1] BF: *Bicep femoris,* LD: *Longissimus dorsi*, PM: *Psoas major*, SM:*Semimembranosus.*

IV. CONCLUSION

M. Psoas major of procine major muscle accelerated color deterioration during cold storage. PM samples showed significantly($p<0.05$) lower CIE L*-value and a*-values compared to other mucels at 7 days of cold storage and the oxidation Mb was related Mb oxidantion , pH and Mb content.

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