THE CORRELATION OF THREE RIGOR MORTIS DEGREE CARCASSES AND PALE SOFT AND EXUDATION, REDDISH SOFT AND EXUDATION, REDDISH PINK AND FIRM AND DARK FIRM AND DRY MEAT

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Introduction

The degree of rigor mortis pork carcasses were affected by muscle sarcoplasmic calcium concentration and rate of energy metabolism. Chang et al. (2004) reported that the post-mortem pork carcasses were determined by simple tension load tester on front leg at 45 minutes of post mortem and the pork carcasses were divided into three groups of rigor mortis degrees (slight, medium and extreme). The slight rigor mortis carcasses had a slower energy metabolism and a high quality meat (water-holding capacity, emulsifying capacity and protein functional characteristics) in $4\Box$ chiller for 24 hours, but the three rigor mortis degree carcasses of quality stability during storage time was unknown. The purpose of this study was to investigate the correlation among the three groups of rigor mortis degree carcasses and forming of PSE meat, RSE, RFN meat, and DFD meat, on the other hand, the handled various fresh meat ($4\Box$) from three groups of rigor mortis degree carcass to compare the variation of quality stability during storage time.

Materials and methods

- **1.** Sampling: The live-weight of the hogs was approximately 100-110kg, and the hogs were slaughtered by electrical stunning and exsanguinations (Walhalla, Stork, Netherland) at a local abattoir. Within 45 minute post mortem, three levels of rigor mortis carcasses (slight, medium and extreme) were determined by tension load tester (Chang et al., 2004). Ten carcasses of each group of rigor mortis carcasses were randomly sampled at 45 minute post mortem. We took *Longissimus dorsi* (LD, 4th to 5th rib) muscle on the right half carcass and stored at 4°C chilling room for three days.
- 2. Four pork qualities were classified as shown in Table 1 (by the method of Warner et al., 1997).

3. Analysis methods

Antioxidant enzymes activity: The antioxidant enzymes of all samples assay were performed as described by De Vore and Greene (1982); Günzler and Flohé (1985).

a. *Superoxide dismutase (SOD) activity* was performed by the riboflavin/nitro blue tetrazolium (NBT) photochemistry

Table 1. The classification of four pork qualities

Four pork qualities	Condition				
Pale, soft, exudative (PSE)	L* > 50, drip >5%, pHu <6.0				
Reddish-pink, soft, exudative (RSE)	L*=42-50, drip >5%, pHu <6.0				
Reddish-pink, firm, non-exudative (RFN)	L*=42-50, drip <5%, pHu <6.0				
Dark, firm, dry (DFD)	L*<42, drip $<5\%$, pHu ≥ 6.0				

analysis method as described by Beauchamp and Fridovich (1971). b. *Glutathione peroxidase (GSH-Px) activity* analysis was performed as described by De Vore and Greene (1982). c. *Catalase (CAT) activity* analysis was using a modified by Aebi (1983) and Mei et al., (1994).

pH value of the tested sample was measure using a pH meter. *Hunter L* value* of the tested sample was recorded using a color difference meter. The *thiobarbituric acid (TBA)* value of the samples were determined by the Tarladgis et al., (1960) as modified by Aipser and Watts (1962) and Ockerman (1974), and was expressed as mg malonaldehyde equivalent/kg sample. *Metmyoglobin (MMb)* content were using the procedure of Chu et al., (1987) and Trout (1989). and then calculated using the formula by Krzywicki (1982).

Results and Discussion

The drip loss in *Longissmus dorsi* of the extreme, medium and slight rigor mortis group during chilled storage time were 5.35%, 3.06% and 3.13% shown in **Table 2**, respectively, which the extreme rigor mortis group was higher than the others. At chilled stored day 0, the pH value of extreme rigor mortis group was significantly (p < 0.05) lower than slight rigor group, but the medium rigor group was not significantly different with slight rigor group. The L^* (lightness) of three rigor mortis groups were more than 50. On the other hand, three groups were not significantly different on day 0, but the L^* of the extreme rigor mortis carcass was higher on day 1 and 3. Summarizing these results, the L^* of slight and medium rigor mortis groups were more than 50, the drip loss was lower 5% and pH value was more than 5.8, therefore, pork quality of slight and medium rigor mortis group was significantly higher than the other groups during storage time. Nevertheless, three groups were not significantly different in 4° C chilled storage. Tam et al. (1998) indicated that the metmyoglobin accumulation and the oxymyoglobin autoxidation speed increased along with the pH value decreased. Our data showed that pH value of extreme rigor mortis group was lower resulting in metmyoglibin accumulation increased. The TBA value of the extreme and medium rigor groups was significantly higher than the other set the pH value decreased. The TBA value of the extreme rigor mortis groups was lower frequence of the extreme rigor mortis groups at day 3. The SOD

among the three groups was not significantly different during the periods of storage time. The GSH-Px of slight rigor group was significantly higher than the medium and extreme rigor groups at day 0 and day 1, respectively. However, the CSH-Px activity was clearly decreased at day 3, but the differences were not significantly in all treatments. The slight rigor mortis group had the highest activity and stability of CAT. However, the medium rigor was not significant different with the other groups.

		Items			
Days	Groups	drip loss	pH value	L^*	
	Extreme rigor		5.65±0.03°	55.00±0.50	
Day 0	Medium rigor		5.84 ± 0.05^{b}	52.20±1.14	
-	Slight rigor		6.05 ± 0.05^{a}	51.77±0.95	
	Extreme rigor	5.35±0.75 ^a	5.63±0.04 ^b	58.30±1.01ª	
Day 1	Medium rigor	3.06±0.34 ^b	5.93±0.03 ^a	53.64±1.49 ^b	
-	Slight rigor	3.13±0.37 ^b	5.90±0.02ª	52.92±0.52 ^b	
	Extreme rigor		5.68±0.04 ^b	55.76±0.79 ^a	
Day 3	Medium rigor		5.96±0.01 ^a	54.91±2.13 ^{ab}	
	Slight rigor		5.99±0.03ª	53.00±1.23 ^b	

Table 2. The correlation between different rigor mortis degree carcasses and PSE, RSE, RFN and DFD meat.

Values given are mean \pm standard error

^{a, b, c}Means within the same column with different superscripts are significantly different (p <0.05).

 Table 3. Difference of lipid oxidation and antioxidant enzyme activity in Longissmus dorsi muscle at chilled storage among different rigor mortis degree carcasses pork.

		Items				
Days	Groups	MMb(%)	TBA(mg/kg)	SOD	GSH-Px	CAT
Day 0	Extreme	33.67 ± 1.04^{a}	0.085 ± 0.005	108.78±9.72	77.90 ± 2.20^{b}	185.0 ± 8.6^{b}
	Medium	20.60 ± 1.73^{b}	0.072 ± 0.005	103.22±6.86	76.90 ± 1.70^{b}	189.2 ± 5.2^{a}
	Slight	20.85 ± 1.43^{b}	0.061 ± 0.006	125.11±9.45	85.40 ± 3.14^{a}	197.5±9.5 ^a
Day 1	Extreme	27.64±1.53 ^a	0.087 ± 0.007	82.67±7.10	73.56±2.31 ^a	180.1 ± 8.6^{b}
	Medium	17.67±0.63 ^b	0.078 ± 0.011	77.67±9.77	73.90±1.13 ^a	191.3±5.7 ^b
	Slight	16.84 ± 1.52^{b}	0.074 ± 0.010	89.61±3.66	68.40 ± 0.94^{b}	202.7 ± 5.5^{a}
Day 3	Extreme	31.38±1.39 ^a	0.114±0.018	91.37±6.61	86.40±2.22	170.5±5.1 ^b
	Medium	31.31 ± 1.82^{a}	0.122 ± 0.008	83.63±5.37	84.90±2.23	216.6±8.3 ^a
	Slight	25.78 ± 0.78^{b}	0.099 ± 0.007	94.57 ± 4.87	81.73±1.78	240.6±13.5 ^a

Values given are mean \pm standard error

^{a, b, c} Means within the same column with different superscripts are significantly different (p <0.05).

Conclusions

The extreme rigor mortis carcasses were significantly higher drip loss and lower pH value which the meat quality was inclinable to come into RSE meat. On the other hand, the antioxidant enzyme activity of the extreme rigor mortis carcasses was lower than others and had poor lipid stability during cold storage time. Further, our study was shown that the RSE meat was inferior to the RFN meat.

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