การศึกษาเปรียบเทียบคุณภาพและสีของเนื้อระหว่างการเก็บรักษาซากสุกร

Comparative study on pork quality and shelf life color of pork carcass

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บทคัดย่อ: การศึกษาในครั้งนี้มีวัตถุประสงค์เพื่อเปรียบเทียบถึงผลของการตรึงขาหลังสุกรในขั้นตอนการฆ่าต่อคุณภาพของเนื้อและลักษณะปรากฏของสีระหว่างการเก็บรักษา โดยใช้สุกรลาจนไวน์จำนวน 6 ตัว น้ำหนักเฉลี่ย 130 กก. ในขั้นตอนการฆ่ามีการตรึงขาของสุกรข้างหนึ่ง (shackled) และขาอีกข้างหนึ่งปล่อยอิสระ (non-shackled) บันทึกค่าความเป็นกรด-ด่างเนื้อสันนอก (loin) และเนื้อสะโพก (ham) ทุกๆ 1 ชั่วโมงภายหลังการฆ่าตลอดระยะเวลา 4 ชั่วโมง ทำการบ่มซากสุกรนาน 9 วัน ก่อนเก็บตัวอย่างเนื้อสันนอกเพื่อวิเคราะห์ถึงค่าแรงตัดผ่านเนื้อและลักษณะปรากฏของสี (L*,a*,b*, color saturation and hue angle) ทุกๆ 1 วันเป็นเวลา 7 วัน จากผลการทดลองพบว่าผลของการตรึงขาสุกรในขั้นตอนการฆ่าไม่ส่งผลต่อค่าความเป็นกรด-ด่าง แรงตัดผ่านเนื้อและลักษณะปรากฏของสีในระหว่างการเก็บรักษา (P>0.05)
คำสำคัญ: เนื้อสุกร ความเหนียวนุ่ม การตรึง อายุการเก็บรักษา สี

ABSTRACT: The objectives of this study were to determined the variation of quality and shelf life color of pork carcass as affected by leg shackling. Six Largewhite barrows (130 kg) were slaugtered and one side of hind leg was shackled before exsanguination. The carcasses were splitted to two sides (shackled vs non-shackled) and carcass pH at loin and ham were recorded every 1 h for 4 h postmortem. Pork carcasses were aged for 9 days and loin samples were collected to determine for shear force and shelf life color everyday for 7 days. The result showed that pH at loin (*Longissimus dorsi* muscle) and Ham (*Gluteus medius* muscle) were similar between shackled and non-shackled side (P>0.05). The shear force of loin samples were similar between treatments. The color (L*,a*,b*, color saturation and hue angle) of meat samples showed no significantly differrence between shackled and non-shackled (P>0.05). Base on this study, it could be concluded that the leg shackled and non-shackled had no effect on muscle pH, shear force value and shelf life color of meat.
Keywords: pork, tenderness, shackling, shelf life, color

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Introduction

One of the most important in meat quality is the appearance meat color. The consumers desire to buy pork by determine with their eyes before another meat quality (George et al., 1999; Hamby, 1992; Morgan et al., 1991). Additionally, meat color can indicate to other pork quality such as pale, soft, exudative (PSE) and dark, firm, dry (DFD) meat.

Many researches had shown that variability of pork quality can be attributed to genetics, breeding, nutrition and post slaughter processes (Canon et al., 1995). However, there is limited information to explain the variation of meat quality within the single carcass.

The slaughter process is an important factor which can be impacted on meat quality. A lot of muscle activity during exsanguinations before scalding showed a detrimental effect on pork quality. The physiological change in swine associated with muscle activity are the increasing of muscle lactate accumulation and change in muscle pH. The objectives of this study were to determine the effect of a slaughter method on the differences of meat quality and shelf life color between pork carcass which shackled and non-shackled during exsanguination before scalding.

Materials and Methods

Pig Slaughter and pH Measurement

Six Largewhite crossbred barrows (130.78 ± 3.68 kg) were delivered to the slaugter-house. Pigs were stunned using electrical stunning and one side of hind leg was shackled while the other was free during exsanguination (approximately 5 min) process before scalding. All carcasses were placed in air cooler (4°C) for approximately 24 h. Every 1 h to 4 h postmortem, pH was measured at loin muscle (10^{th} to 11^{th} rib) and ham (both the shackled and non-shackled sides of the carcass with a glass tipped pH Meter (HANNA instruments, RI).

Shear Force

After aging for 9 days, loin samples were cut into 1 inch thick and cooked according to the guidelines published by American Meat Science Association (AMSA, 1995) using an electric grill (George Foreman Grill, GRP99) on both side. After internal temperature reached 70 °C, samples were removed from the grill and cooled to room temperature (20 °C). Four to six cores (diameter=1.27 cm) were removed from each steak (parallel to muscle fiber). Each core was sheared once perpendicular to the longitudinal orientation of the muscle fiber by Shear Force Instrument (Mecmesin Warner Bratzler Meat Shear: Basic Shear Gauge 13FG5001N, SIB 06-0290-11: G-RManufacturing Co, Manhattan, KS). The average shear force and standard deviation were calculated for each sample.

Shelf Life Color Measurement

The LM samples were collected from the carcass at 10^{th} to 13^{th} rib, trimmed of external fat and placed into the chilling room (4°C). All samples were determined for L*, a* and b* using Konica Minolta CR-410 Colorimeter (Konica Minolta Inc., Japan). Color measurement was recorded every 1 day for a 7 days period. Hue angle (arctangent $[\{b^*/a^*\} \times 360^\circ]/[2 \times 3.14]$ and chroma (square root $[a^*]^2 + [b^*]^2$) were calculated (Minolta, 1994).

Statistical Analysis

All data were analyzed using the GLM procedure of SAS (SAS Inst., Inc., Cary, NC); individual carcass served as the experiment unit. Means of all comparisons means were compared according to student t-test (Steel et al., 1997).

Results

Intramuscular pH and Shear force

The postmortem pH of *Longissimus dorsi* muscle (LM) and *Gluteus medius* muscle (GM) were not differences between shackled and non-shackled side of pork carcasses (P>0.05) as showed in **Table 1**.

Table 1. Bilateral differences in i.m. pH of the LM and GM

	Bilateral difference			
Variable	Shackled (n = 6)	Non-Shackled (n = 6)	SEM	P-value
LM				
pH at 1 h	6.00	5.92	0.10	0.58
pH at 2 h	5.55	5.51	0.06	0.68
pH at 3 h	5.52	5.60	0.07	0.42
pH at 4 h	5.50	5.53	0.04	0.58
GM				
pH at 1 h	6.19	6.02	0.18	0.51
pH at 2 h	6.08	5.95	0.16	0.58
pH at 3 h	6.01	5.82	0.15	0.38
pH at 4 h	5.61	5.72	0.09	0.39
Shear force	2.77	2.47	0.21	0.35

Shelf life Color Measurements

All shelf life color parameter showed non-significantly differences of shackled and non shackled side (P>0.05) as showed in **Table 2.**

Table 2. Shelf life of bilateral symmetry effects on objective color measurements of loin section

Item	Days of shelf life						
	1	2	3	4	5	6	7
Lightness (L*)							
Shackled	62.55	62.06	61.77	62.25	62.86	63.42	63.68
Non-shackled	63.52	63.55	63.53	63.27	64.19	64.59	64.65
SEM	1.70	1.84	1.77	2.02	2.06	2.07	2.18
P-value	0.70	0.59	0.50	0.73	0.66	0.70	0.76
Redness (a*)							
Shackled	16.04	14.38	13.28	12.92	11.87	11.04	10.52
Non-shackled	15.56	14.59	13.60	12.99	12.53	11.98	11.56
SEM	0.19	1.64	2.03	2.31	2.53	2.59	2.69
P-value	0.12	0.92	0.91	0.98	0.85	0.80	0.79
Yellowness (b*)							
Shackled	10.01	11.18	10.98	11.29	11.11	11.21	11.22
Non-shackled	9.75	11.14	10.91	11.16	11.05	11.06	11.05
SEM	0.43	0.18	0.18	0.21	0.16	0.14	0.15
P-value	0.61	0.89	0.78	0.67	0.79	0.47	0.44
Color saturation							
Shackled	18.92	18.28	17.34	17.30	16.51	16.06	15.75
Non-shackled	18.37	18.45	17.60	17.39	17.02	16.66	16.42
SEM	0.18	1.34	1.58	1.73	1.81	1.75	1.74
P-value	0.07	0.92	0.91	0.97	0.84	0.81	0.79
Hue angle							
Shackled	35.82	46.00	50.40	54.37	61.53	70.69	77.07
Non-shackled	35.95	45.97	50.96	58.44	62.64	68.10	76.62
SEM	1.82	5.47	9.00	6.07	4.99	3.61	2.66
P-value	0.36	0.84	0.96	0.83	0.66	0.83	0.79

Discussion

During slaugtering process, muscle had numerous metabolic mechanisms involved in postmortem pH decline. Normally, the muscular pH had been changed by lactic acid accumulation in the muscle. The level of lactic acid is increase relate with the increasing of muscular activity before slaugter. Therefore, one side leg of pigs shackled carcass had limited the activity while the another side was free to the activity during the slaugter. The carcass with free to access to had activity should have low pH due to more lactic acid was produced in pig muscle during the sluagter process. The data showed that muscular pH of the shackled side were higher than non-shackled side (approximately 0.08 pH unit in LM and 0.17 pH unit in GM) but the data was not significantly difference (P>0.05). However, Stahl et al. (2006); Fischer and Augus-

tini (1998) showed that the intermuscular pH of shackled side were higher than non-shackled side.

The intramuscular pH is an important factor to predict pork quality especially color and water holding capacity (Norman et al., 2003; Schafer et al, 2000) the derease of intramuscular pH will tranfer the water with pigment (myoglobin) out of the myofibril. In this study all data of shelf life color showed no difference between shackled and non-shackled side (**Table 2**). This due to the intramuscular pH was slightly change between shackled and non-shackled side. So, It will be not effect on the shelf life color.

Conclusion

The variation of pork carcass as affected on shackled and non-shackled showed no difference for the intramuscular pH ($P>0.05$) and shear force value. The shelf life color were also similar between treatments.

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