Carcass Quality and Meat Quality of Fattening Pigs Derived from Pakchong 5 and Duroc Breed Terminal Boars

Wilaiwan Thaenthanee[1,*], Kamon Chaweewan[1] Chanporn Chaosap[2],

Rutcharin Limsupavanich[3] and Ronachai Sitthigripong[3]

[1] Nakornratchasima Livestock and Breeding Center, Department of Livestock Development, 30130, Thailand
[2] Faculty of Industrial Education, King Mongkut's Institute of Technology Ladkrabang, 10520, Thailand
[3] Faculty of Agricultural Technology, King Mongkut's Institute of Technology Ladkrabang, 10520, Thailand
[*]Corresponding author email: wilaiwan1980@hotmail.com

Abstract – The purpose of this study to examine meat quality of fattening pigs derived from terminal boar; Pakchong 5 (PC5) and Duroc (DR). Pakchong 5 is synthetic breed that composed of Duroc and Pietrian breed. Sixteen pigs in each group (8 castrated males and 8 females) were slaughter and meat were collected for further study. The collected data were analyzed using General linear model (GLM) and Analysis of variance (ANOVA). Results indicated that carcass percentages and most parts obtained from carcass dressing were not significantly different between PC5-derived fattening pigs (PCF) and DR-derived fattening pigs (DRF). However, the carcass length of DRF was longer than PCF (P<0.05) and fat percentage and Lenden-Speck-Quotient Index (LSQ) of PCF were higher than DRF (P<0.05). Most of chemical composition and physical characteristics of *Longissimus dorsi* (LD) muscles were not significantly different among groups. The yellowness (b*) of PCF was higher than DRF (P<0.05). Muscle fiber diameters of PCF were larger than DRF (P<0.05). The effects of gender were also found in this study. The fat percentage and meat lightness (L*) of male were higher than female (P<0.05). In conclusion, carcass quality and meat quality of fattening pigs derived from Duroc pigs tend to superior than fattening pigs derived from synthetic terminal boars.

Key Words –Pakchong 5-derived fattening pigs, Duroc-derived fattening pigs, Carcass, Meat

I. INTRODUCTION

Pakchong 5 (PC5) is synthetic terminal boar that was bred from Duroc and Pietrain pigs (Duroc x Pietrain). The PC5 was used to produce high productivity fattening pigs with increased growth rate and lean. The PC5 swine breed derived from the inter se mating and selected over 5 generations on economically important traits. The economical traits of PC5 can be consistence transmitted to the fattening pigs [5]. Thus, the potential of PC5 as terminal boar to produce fattening pigs can improve productivity, reduce costs and increase profits directly to the farmers. However, carcass and meat quality of PC5 including its fattening pigs still have not been addressed. Due to behavior of consumer tend to change to the quality meat, to study in meat science of PC5 and its fattening pigs will be extended to meat products development and consumer demand. The PC5 terminal boar will be promoted to farmer in swine production. In this study, carcass and meat quality of PC5-derived and Duroc-derived fattening pigs were compared.

II. MATERIALS AND METHODS

The study was carried out on of fattening pigs derived from terminal boar; Pakchong 5 (PCF) and Duroc (DRF). Each group comprised 16 pigs (8 castrated male and 8 female) were fattened from 20 to 110 kg body weight. Initial and final weight was records.

Carcass and meat quality measurements

Pigs were slaughtered after reaching 110 kg body weight with the measurements of their carcass and meat quality. Live weight, warm carcass weight, carcass length and back-fat thickness were collected. Loin eye area was determined using area meter (LI-3100C) from drawing surface area at the *Longissimus dorsi* muscle between the 10th and 11st rib. Lenden-speck quotient (LSQ) index was calculated from the left side carcass according to Jutharat's method [12]. Temperature and pH was measured in the *Longissimus dorsi* muscle between the 10th and 11st rib using pH meter (Metler-Toledo, SevenGoTM SG2) at 45 min

(pH45) and 24 h and (pH24) after slaughter. Carcass and fat percentage were calculated. The samples were collected from the loin of the left side carcass. Color parameters were determined using a Minolta Chromameter CR-300 with an Illuminant D65 and 2° observer interpret in form of L* (lightness) a* (redness) and b* (yellowness). Drip loss, thawing loss and cooking loss were defined. Shear force was analyzed (Warner-Bratzler shear force) using Texture analyzer (Instron model 1011, USA) according to Wheeler *et al.* [16]. Chemical composition of meat were analyzed, i.e. total protein, fat, ash and dry matter [4]. Collagen analysis according to Wheeler *et al*. [16], muscle fiber diameter according to Melton *et al*. [10] and Sarcomere length analysis according to Cross *et al*. [6] using Helium-Neon Laser SC-31004. Statistical analysis was performed using General linear model (GLM) in order to determine the carcass and meat quality. Least Square Mean (LSM) using pdiff was applied to compare the mean value.

III. RESULTS AND DISCUSSION

The obtained results indicated that carcass percentages and most parts obtained from carcass dressing were not significantly different between PCF and DRF. However, the carcass length of DRF was longer than PCF ($P<0.05$) and fat percentage and Lenden-Speck-Quotient Index (LSQ) of PCF were higher than DRF ($P<0.05$). LSQ index using evaluated carcass quality by back-fat thickness measure with loin eye area, if they are highly lean percentage, LSQ index will be low [11]. However, have been reported that Duroc, Duroc x Landrace x Large white and Pietrain x Landrace x Large white were not significantly different in loin eye area and back-fat thickness at the last rib [10]. Alberto *et al* [2] reported that pigs with 0% (LWxL), 25% [LWx(DxL) and Lx(DxLW)] and 50% [Dx(LWx(LWxL))] of Duroc breed genes have lower carcass length when the proportion of Duroc genes increased ($P<0.01$).

This study also confirmed that sex have not significant different in carcass quality paralleled with Latorre *et al.*[8] found that castrated male and female results in no significant difference in loin weight. In fact, castrated male contained higher level of fat in comparison with female.

Table 1 Carcass quality of fattening pigs derived from PC5 and Duroc breed terminal boar.

Traits	Breed		Sex	
	PC5	Duroc	Male	Female
Number of pigs	16	16	16	16
Carcass weight (kg.)	84.673	88.280	88.914	84.343
Carcass length (cm.)	84.933[b]	89.133[a]	87.429	86.688
Carcass percentage (%)	78.561	78.670	78.643	78.589
Lean percentage (%)	44.319	45.039	44.227	45.075
Loin percentage (%)	8.130	8.214	7.886	8.423
Ham percentage (%)	19.290	19.849	19.499	19.631
Fat percentage (%)	13.048[a]	11.687[b]	13.055[a]	11.766[b]
Belly percentage (%)	13.513	12.726	13.574	12.721
Backfat thickness (mm.)	22.949	20.426	23.250	20.320
Loin Eye Area (cm^2)	53.033	46.529	51.039	48.681
LSQ	0.263[a]	0.211[b]	0.253	0.223

[a,b] Mean within a row having different superscript are significant different ($P<0.05$)

The present finding that there were no significant difference in meat quality i.e. pH_{45}, pH_{24}, drip loss, thawing loss, cooking loss, shear force, Sarcomere length and chemical composition of meat between PCF and DRF except the yellowness (b*) of PCF was higher than DRF ($P<0.05$). The muscle fiber diameters of PCF were larger than DRF ($P<0.05$) as presented in table 2. Latorre *et al.* [9] reported the effect of breed and sex to chemical composition in muscle found that Duroc x Large White and Pietrain x Large White cross bred pigs were no significant different in dry matter, total protein and fat. These reported also stated that total protein in loin muscle were no significant different between castrated male and female. Weston *et al*. [15] reported that connective tissue was correlated with meat tenderness. However, soluble and insoluble collagen were not significant different consistent with Alonso *et al.* [3] and McCann *et al.*[10] who reported that Duroc x Landrace x Large White and Pietrain x Landrace x Large White were no significantly difference in pH_{24}, meat lightness (L*), meat redness (a*) and yellowness (b*), drip loss, cooking loss and shear force in loin. Considerate pH_{45} and meat lightness (L*) in both groups, this study found that there were stated in the regular range (pH_{45} 6.19-6.33 and L* between 51.25-51.92) not likely to be Pale Soft Exudative (PSE; pH_{45} < 5.3, L* 42-48) or Dark Firm Dry (DFD; pH_{45} > 6.4, L* 60-66) [1,7,14].

The effects of gender were also found in this study. The fat percentage and meat lightness (L*) of male were higher than female ($P<0.05$). (table 2). Meanwhile, Alonso *et al.* [3] have been reported that castrated male and female were no significant difference in meat lightness but castrated male was higher redness and yellowness (a* and b*) than female. In addition, Latorre *et al.* [8] stated that castrated male was higher yellowness (b*) than female.

Table 2 Meat quality of fattening pigs derived from PC5 and Duroc terminal boar.

Trait	Breed		Sex	
	PC5	Duroc	Male	Female
Number of pigs	16	16	16	16
pH45 MLD	6.193	6.336	6.191	6.329
pH_{24} MLD	5.715	5.757	5.694	5.771
Meat lightness (L*)	51.921	51.248	53.018[a]	50.330[b]
Meat redness (a*)	4.070	3.460	3.886	3.631
Meat yellowness (b*)	12.35[a]	11.48[b]	12.230	11.630
Drip loss (%)	3.104	3.091	3.060	3.130
Thawing loss (%)	9.049	9.235	9.460	8.863
Cooking loss (%)	22.496	22.281	22.204	22.550
Shear force (N)	6.468	6.239	6.134	6.545
Diameter (μM)	71.83[a]	65.68[b]	68.018	69.391
Sacromere (μM)	1.630	1.660	1.680	1.620
Dry matter (%)	26.723	26.210	26.439	26.494
Protein (%)	23.831	23.579	23.782	23.628
Crude fat (%)	2.110	1.838	1.935	2.013
Ash (%)	1.032	1.019	1.036	1.015
Insoluble collagen (%)	3.364	3.459	3.187	3.636
Soluble collagen (%)	0.597	0.485	0.504	0.578

[a,b] Mean within a same row having different superscript showed significant different ($P<0.05$)

IV. CONCLUSION

Carcass quality and meat quality of fattening pigs derived from Duroc pigs tend to superior than fattening pigs derived from synthetic terminal boars.

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REFERENCES

1. Adzitey, F. and H. Nurul. (2011). "Pale soft exudative (PSE) and dark firm dry (DFD) meats: causes and measures to reduce these incidences - a mini review." International Food Research Journal 18: 11-20.
2. Alberto Sabbioni, Paola Superchi, Claudia Sussi, Alberto Bonomi. (2002). Effect of Duroc genes proportion on growth performance and on carcass and meat quality characteristics in heavy pigs. Italian Journal of Animal Science, 1:1, 17-24
3. Alonso, V., M. Campo Mdel, S. Espanol, P. Roncales and J. A. Beltran. (2009). "Effect of crossbreeding and gender on meat quality and fatty acid composition in pork." Meat Science 81(1): 209-217.
4. AOAC. (2005). Official methods of analysis. Washington, DC., AOAC Int.
5. Chaweewan, K., S. Nakavisut, V. Jumparat and V. Srisuriya. (2012). Genetic Parameters of Selection for Economic Traits over Five Generations of Pakchong 5 Swine. The 15th AAAP Animal Science Congress, Thammasat University, Rangsit Campus, Thailand: 1347-1351.
6. Cross, H. R., R. L. West and T. R. Dutson. (1981). "Comparison of methods for measuring sarcomere length in beef semitendinosus muscle." Meat Science 5(4): 261-266.
7. Faucitano, L., M. C. Ielo, C. Ster, D. P. Lo Fiego, S. Methot and L. Saucier. (2010). "Shelf life of pork from five different quality classes." Meat Science 84(3): 466-469.
8. Latorre, M. A., R. Lazaro, M. I. Gracia, M. Nieto and G. G. Mateos. (2003a). "Effect of sex and terminal sire genotype on performance, carcass characteristics, and meat quality of pigs slaughtered at 117 kg body weight." Meat Science 65(4): 1369-1377.
9. Latorre, M. A., P. Medel, A. Fuentetaja, R. Lázaro and G. G. Mateos. (2003b). "Effect of gender, terminal sire line and age at slaughter on performance, carcass characteristics and meat quality of heavy pigs." Animal Science 77: 33-45.
10. McCann, M. E. E., V. E. Beattie, D. Watt and B. W. Moss. (2008). "The effect of boar breed type on reproduction, production performance and carcass and meat quality in pigs." Irish Journal of Agricultural and Food Research 47: 171–185.
11. Melton, C., M. Dikeman, H. J. Tuma and R. R. Schalles. (1974). "Histological Relationships of Muscle Biopsies to Bovine Meat Quality and Carcass Composition1,2." Journal of Animal Science. 38(1): 24-31.
12. Sethakul, J. (1997). Slaughter House Management. Bangkok, King Mongkut's Institute of Technology Ladkrabang.
13. Sethakul, J., P. Sivapirunthep, W. Asawaphannimit and N. Piyasatian. (2010). Use of the LSQ Index to Assess Commercial Cuts of Pork Carcass. Proceeding of the Meat Science and Technology, Bangkok, King Mongkut's Institute of Technology Ladkrabang: 26-32.
14. Warriss, P. D. and S. N. Brown. (1987). "The relationships between initial pH, reflectance and exudation in pig muscle." Meat Science 20(1): 65-74.
15. Weston, A. R., R. W. Rogers and T. G. Althen. (2002). "Review: The Role of Collagen in Meat Tenderness." The Professional Animal Scientist 18(2): 107-111.
16. Wheeler, T. L., S. D. Shackelford and M. Koohmaraie. (2005). "Shear Force Procedures for Meat Tenderness Measurement."