EFFECTS OF COMMERCIAL MATERNAL LINES ON MEAT QUALITY CHARACTERISTICS AND FATTY ACID COMPOSITION OF PORCINE *LONGISSIMUS* MUSCLE

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Abstract— **This study was conducted to understand that how commercial maternal lines are affecting pork quality by comparing of meat quality traits and fatty acid composition in progeny. Four commercial maternal lines were crossed with same Duroc line pigs, produced 240 animals, and at market weight they were conventionally slaughtered and then chilled overnight. *Longissimus* muscles were removed for the meat quality traits and fatty acid composition. In moisture, T1 and T3 had higher values than T2 and T4($p<0.05$). In protein, no significant differences were detected for all groups. In fat, T2 and T4 had higher values than T1 and T3 ($p<0.05$). In ash, T4 had higher value than the others($p<0.05$). However, chemical composition of porcine *longissimus* muscle was not very different among groups of commercial maternal line. In pH, T4 had higher value than the others($p<0.05$). In water holding capacity, T2 and T3 had higher values than T1 and T4($p<0.05$). In drip loss, T2 and T3 had higher values than T1 and T4 ($p<0.05$). In cooking loss, T2 had higher value than T4 ($p<0.05$). In shear force, T1 and T4 had higher values than T2 and T3 ($p<0.05$). In the Hunter color, significant maternal line differences were observed among maternal lines. T2 had higher L^* value than the others ($p<0.05$). In a^* value, T1 had higher value than the others ($p<0.05$). In b^* value, T2 had higher value than the others ($p<0.05$). T4 was judged to superior meat quality characteristics for pH, drip loss and cooking loss. In the subjective evaluation, marbling of T4 had higher score than the others ($p<0.05$). In texture, T1 and T4 had higher scores than T2 and T3 ($p<0.05$). In color, T2 had lower score than the others ($p<0.05$). In total acceptability, T1 had higher score than T3 ($p<0.05$). In the storage characteristics during 14day cooler storage, as 2-thiobarbituric acid and volatile basic nitrogen values were within the safe range, commercial maternal lines did not show any effect on storage characteristics. In the fatty acid composition, palmitic acid(C16:0) and stearic acid(C18:0) were main saturated fatty acids in pigs of Duroc crossed commercial maternal lines. In palmitic acid(C16:0) and stearic acid(C18:0), T4 had higher values than the others ($p<0.05$). Oleic acid(C18:1) and linoleic acid(C18:2) were main unsaturated fatty acids. In oleic acid, T4 had higher value than the others ($p<0.05$). In linoleic acid, T4 had lower value than the others ($p<0.05$). In ratio of total unsaturated fatty acid and saturated fatty acid, T4 had lower value than the others ($p<0.05$).**

Key words: Commercial maternal lines, Pork qualty, Fatty acid composition

I. INTRODUCTION

Many factors have an impact on meat quality and growth performance, but those considered the most important with regard to pork are sex, environment and breed. It is well known that meat quality can be affected by breed composition. Currently, pig production in Korea has been based on crossing Ladrace X Yorkshire dams with sire lines, such as Duroc or Hampshire for slaughtering gilts and barrows at approximately 105~110 kg, due to feed costs and meat yield. As a result, it has proven to have more meat yield, but meat quality in commercial pigs has been lowered (Oh et al., 2008). The market on pork consumption in Korea revealed that higher marbling on meat is preferred than lower marbling meat by consumers.

Previous studies have shown that pork from progeny of Duroc sires was juicier and more acceptable than pork from European breeds (Ellis et al., 1996). However, the production of pigs with 50-100% Duroc genes was not found to be an effective way of improving eating quality, as genotype did not influence any of the sensory attributes assessed in study of Channon et al. (2004). Accordingly, the objective of this study was to assess that how much the meat quality characteristics and fatty acid composition are affected by different commercial maternal lines (four popular lines). Also this investigation will provide useful information in the search for superior maternal lines.

II. MATERIALS AND METHODS

This study was accomplished with Duroc crossed commercial maternal lines (four popular lines) pigs, and each maternal line produced sixty animals. Commercial pigs(n=240) were allowed ad libitum access to water and diet during entire experimental period. When the mean weight of pigs in a pen reached market weight, pigs were conventionally

slaughtered and then chilled overnight. *Longissimus* muscles from left side between the 5th and 13th rib were removed and meat qualities were evaluated. Fatty acid composition was analysised by GC using a fused silica capillary column (100m x 0.25 mm, i.d. x 0.20mm, thickness, Supelco, SPTM-2560,USA). The results were analyzed statistically using the SAS statistical package(2002).

III. RESULTS AND DISCUSSION

The chemical composition of each commercial maternal line is listed in Table 1. In moisture, T1 and T3 had higher values than T2 and T4($p<0.05$). In protein, no significant differences were detected for all groups. In fat, T2 and T4 had higher values than T1 and T3 ($p<0.05$). In ash, T4 had higher value than the others($p<0.05$). However, chemical composition of porcine *longissimus* muscle was not very different among groups of commercial maternal line.

The meat quality traits of commercial maternal line are listed in Table 2. In pH, T4 had higher value than the others($p<0.05$). In water holding capacity, T2 and T3 had higher values than T1 and T4($p<0.05$). In drip loss, T2 and T3 had higher values than T1 and T4 ($p<0.05$). In cooking loss, T2 had higher value than T4 ($p<0.05$). In shear force, T1 and T4 had higher values than T2 and T3 ($p<0.05$). In the Hunter color, significant maternal line differences were observed among maternal lines. T2 had higher L^* value than the others ($p<0.05$). In a^* value, T1 had higher value than the others ($p<0.05$). In b^* value, T2 had higher value than the others ($p<0.05$). T4 was judged to superior meat quality characteristics for pH, drip loss and cooking loss.

In the subjective evaluation (Table 3), marbling of T4 had higher score than the others ($p<0.05$). In texture, T1 and T4 had higher scores than T2 and T3 ($p<0.05$). In color, T2 had lower score than the others ($p<0.05$). In total acceptability, T1 had higher score than T3 ($p<0.05$).

In the storage characteristics during 14day cooler storage (Table 4), T1 showed higher TBA(2-thiobarbituric acid) value than the others on 0 and 7day of storage ($p<0.05$). In VBN(volatile basic nitrogen), T2 had higher value than the others on 7 and 14day of storage ($p<0.05$). As their values were within the safe range, commercial maternal lines did not show any effect on storage characteristics.

In the fatty acid composition (Table 5), palmitic acid(C16:0) and stearic acid(C18:0) were main saturated fatty acids in pigs of Duroc crossed commercial maternal lines. In palmitic acid(C16:0) and stearic acid(C18:0), T4 had higher values than the others ($p<0.05$). Oleic acid(C18:1) and linoleic acid(C18:2) were main unsaturated fatty acids in pigs of Duroc crossed commercial maternal lines. In oleic acid, T4 had higher value than the others ($p<0.05$). In linoleic acid, T4 had lower value than the others ($p<0.05$). In ratio of total unsaturated fatty acid and saturated fatty acid, T4 had lower value than the others ($p<0.05$).

IV. CONCLUSION

Four maternal lines of pigs were evaluated to assess the meat quality characteristics and fatty acid composition of porcine *longissimus* muscle by crossing same terminal Duroc. In general, finishing pigs did not have much difference in meat quality measurements from this study. However, T4 showed better in overall meat quality measurements. Therefore, finishing pigs from these cross breeds can be useful information for pork progeny producer industry where higher pork quality is required.

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Table 1. Effects of commercial maternal lines on chemical composition of porcine *Longissimus* muscle

Items*	Moisture(%)	Protein(%)	Fat(%)	Ash(%)
T1	74.53±0.74[a]	22.30±0.70	2.03±0.65[b]	1.11±0.10[c]
T2	74.07±0.76[b]	22.42±0.68	2.33±0.74[a]	1.15±0.17[b]
T3	74.60±0.73[a]	22.33±0.68	1.93±0.77[b]	1.13±0.11[bc]
T4	73.93±0.76[b]	22.45±0.66	2.26±0.77[a]	1.33±0.14[a]

[a, b, c] Means±SE with different superscription within the same column differ($p<0.05$).
*T1 = A company, T2 = B company, T3 = C company, T4 = D company

Table 2. Effects of commercial maternal lines on meat quality traits of porcine *Longissimus* muscle

Items		T1	T2	T3	T4
pH		5.54±0.11[b]	5.55±0.13[b]	5.53±0.11[b]	5.62±0.12[a]
WHC(%)[A]		57.14±5.52[b]	59.32±5.22[a]	58.95±4.15[a]	57.69±5.24[b]
Drip loss(%)		4.78±1.47[b]	5.23±1.28[a]	5.26±1.72[a]	4.20±2.31[c]
Cooking loss(%)		31.79±2.80[ab]	32.45±4.02[a]	31.89±3.38[ab]	31.21±3.21[b]
Shear force(kg)		1.25±0.44[a]	1.15±0.35[b]	1.10±0.30[b]	1.27±0.47[a]
Hunter Color[B]	L*	60.80±4.96[b]	61.71±4.78[a]	61.01±4.30[ab]	59.19±5.47[c]
	A*	7.87±2.24[a]	7.09±2.24[b]	6.88±2.61[b]	6.17±1.84[c]
	b*	9.72±1.47[b]	10.00±1.47[a]	9.57±1.38[b]	9.09±1.24[c]

[a, b, c] Means±SE with different superscription within the same row differ($p<0.05$).
[A] WHC: water holding capacity
[B] L*: lightness, a*: redness, b*: yellowness.

Table 3. Effects of commercial maternal lines on subjective evaluation[1)] of porcine *Longissimus* muscle

Items	Marbling	Texture	Color	Total acceptability
T1	2.60±0.87[b]	2.94±0.45[a]	3.06±0.47[a]	3.00±0.40[a]
T2	2.56±0.71[b]	2.84±0.41[b]	2.95±0.47[b]	2.94±0.36[ab]
T3	2.48±0.79[b]	2.78±0.43[b]	3.06±0.46[a]	2.90±0.31[b]
T4	2.84±0.78[a]	3.00±0.37[a]	3.12±0.45[a]	2.93±0.34[ab]

[a, b] Means±SE with different superscription within the same column differ($p<0.05$).
[1)] Marbring, 1: extremely low in intramuscular fat, 5: very abundant in intramuscular fat
Texture, 1: extremely coarse in texture, 5: very fine in texture
Meat color, 1: very pale in meat color, 5: very dark in meat color
Total acceptability, 1: extremely unacceptable, 5: extremely acceptable

Table 4. Effects of commercial maternal lines on storage characteristics of porcine *Longissimus* muscle during cooler storage

Items	Storage	T1	T2	T3	T4
TBA* (mg malonaldehyde/ 1,000g)	0 day	0.23 ±0.08^{a}	0.12 ±0.06^{c}	0.12 ±0.07^{c}	0.15 ±0.08^{b}
	7 day	0.26 ±0.08^{a}	0.19 ±0.14^{bc}	0.20 ±0.06^{b}	0.17 ±0.13^{c}
	14 day	0.40 ±0.11^{a}	0.37 ±0.11^{b}	0.40 ±0.08^{a}	0.25 ±0.09^{c}
VBN(mg%)**	0 day	10.81 ±1.26^{c}	12.03 ±2.04^{b}	11.75 ±1.47^{b}	13.58 ±3.24^{a}
	7 day	14.88 ±1.76^{b}	16.10 ±3.33^{a}	15.01 ±2.46^{b}	14.64 ±3.34^{b}
	14 day	15.65 ±2.17^{d}	21.09 ±3.97^{a}	17.08 ±2.66^{c}	18.54 ±1.82^{b}

$^{a, b, c, d}$ Means±SE with different superscription within the same row differ($p<0.05$).
*TBA: 2-thiobarbituric acid
**VBN: volatile basic nitrogen

Table 5. Effects of commercial maternal lines on fatty acid composition of porcine *Longissimus* muscle

Items	T1	T2	T3	T4
C14:0	1.02±0.26^{bc}	0.87±0.31^{c}	1.04±0.21^{b}	1.53±0.10^{a}
C15:1	-	2.40±1.96^{a}	2.02±1.87^{ab}	1.27±0.18^{b}
C16:0	21.83±0.92^{bc}	21.64±1.45^{c}	22.72±2.36^{b}	24.28±0.74^{a}
C16:1	2.96±1.10^{ab}	2.32±1.12^{bc}	2.24±1.23^{c}	3.27±0.16^{a}
C17:0	0.13±0.18^{b}	0.12±0.16^{b}	0.21±0.12^{ab}	0.23±0.06^{a}
C17:1	1.45±1.31^{a}	0.14±0.20^{b}	0.16±0.24^{b}	0.20±0.04^{b}
C18:0	9.48±0.90^{c}	11.051.66^{b}	10.83±0.71^{b}	12.74±0.75^{a}
C18:1	34.54±6.26^{b}	33.68±5.44^{b}	32.07±2.37^{b}	41.37±1.21^{a}
C18:2	21.34±2.65^{a}	19.14±2.91^{b}	21.82±4.24^{a}	10.34±1.32^{c}
C18:3	0.21±0.22	0.32±0.46	0.25±0.23	0.33±0.04
C20:1	0.360.20^{a}	0.04±0.08^{b}	0.03±0.04^{b}	0.04±0.06^{b}
C20:2	0.10±0.18^{c}	0.33±0.33^{b}	0.27±0.24^{b}	0.65±0.04^{a}
C20:3	3.25±2.49^{a}	0.40±0.56^{b}	0.54±0.59^{b}	0.56±0.84^{b}
C20:4	0.01±0.01^{c}	3.47±2.74^{a}	2.89±2.68^{a}	1.54±1.05^{b}
C24:0	0.05±0.06	0.17±0.32	0.12±0.18	0.10±0.08
C22:6	0.31±0.29^{b}	0.51±0.40^{a}	0.25±0.23^{b}	0.15±0.03^{b}
C24:1	0.761.36^{bc}	1.47±0.60^{a}	1.18±0.90^{ab}	0.38±0.06^{c}
SFA*	34.13±1.82^{c}	34.28±2.02^{bc}	35.43±2.42^{b}	39.19±1.34^{a}
Mono-USFA	39.36±6.00^{b}	40.03±3.84^{b}	37.31±4.23^{b}	46.82±1.10^{a}
Poly-USFA	25.73±5.26^{a}	24.20±3.17^{a}	26.06±2.40^{a}	13.59±1.68^{b}
USFA**	65.86±1.82^{a}	65.71±2.02^{ab}	64.56±2.42^{b}	60.80±1.34^{c}
USFA/SFA	1.93±0.15^{a}	1.92±0.16^{a}	1.83±0.19^{a}	1.55±0.08^{b}

$^{a, b, c}$ Means±SE with different superscription within the same row differ($p<0.05$).
*Saturated fatty acid
**Unsaturated fatty acid