COMPARISON OF PORK QUALITY AND MUSCLE HISTOCHEMICAL CHARACTERISTICS IN DIFFERENT LINES OF JEJU BLACK PIG

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Abstract – For this study, the evaluation of semen for were completed against 18 candidate boars for performance test of boars of Jeju black pig and 4 were selected. Total 4 experimental farms were selected for progeny test and artificial insemi nation was completed against total 134 gilts. The produced piglets based on that were total 1,000 and, as the results of analyzing black piglets, 96.7 % appeared black color and another color appeared from 33 piglets (3.3%) only. The produced number for each candidate gilt was recognized as 9.8 for average, 8.7 for number of born alive and 7.3kg for weaning weight. As much as it is candidate boar with excellent meat quality, it was analyzed that the size of muscle fiber was small and distribution density of muscle fiber Type 1 was higher. It was analyzed that such distribution density of muscle fiber influences on pH, drip loss & meat color of carcass and final meat quality much. It is judged that the profits of farms can be produced by selecting the excellent breeding pig whose capability of producing good meat quality and the excellent breed and cross combination can be selected continuously by registering, preserving and improving the excellent breeding pig through that.

Key Words - Meat quality, Crossbreeding, Carca ss characteristics, Gender, Pork

I. INTRODUCTION

Jeju black pig is well known for the good preference from consumers and its excellent meat quality and property [1]. But, the quality is not equalized for each raising farm [2], nor standardized either and the variation is huge for each farm comparing with its famous brand image.

The reason for that is that the breed of Jeju black pig has not been established clearly yet. So, Jeju needs to reduce the variations for each farm through breed definition of Jeju black pig and it is the right time for Jeju black pig raising business to be constant and develop-mental through the standardization of quality and carcass. For that, this study was carried out to arrange most optimal cross combination for breed establishment of Jeju black pig and basic data for formation of breed targeting the raising farms of Jeju black pig through the analysis of reproductive characteristics, carcass character ristics, characteristics of meat quality and histochemical characteristics of Jeju black pig by the produced piglets from each breed & cross combination.

II. MATERIALS AND METHODS

Animal and experimental design

The evaluation of semen for diseases (turned out to be negative for all as the results of PRRSV & PCV-2 tests) were completed against 18 candidate boars for performance test of boars of Jeju black pig and 4 were selected (MK001, MK002, MK003, MS001). Total 4 experimental farms were selected for progeny test and artificial insemination was completed against total 134 gilts. The produced piglets based on that were total 1,000. Histochemical analysis was performed to analyze the qualitative characteristics among candidate boars. Upper group 20% (MK001 & MK003) and lower group 20% (MS001 & MK002) which are excellent in histochemical respect were selected and comparative analysis was performed for histochemical analysis.

Meat quality measurements

The muscle pH_{45min} and pH_{24h} of postmortem samples were measured directly using a potable pH meter (Model HM-17MX, TOADKK, Japan) . The meat color was assessed at 24h postmortem using a Minolta chromameter (CR-300, Minolta Camera co. Osaka., Japan). The drip loss was

determined by suspending muscle samples standardized for surface area in an inflated clean bag at 4□ for 48h [3]. The cooking loss were estimated by weighing the samples before and after cooking [4]. WBS (Warner-Brratzler Shear force) an indicator of meat tenderess, was determined using an Instron Universal Testing Machine (Rheometer compact 100, sun science co., Japan) Histochemical analysis. The muscle samples taken for histochemical analysis at 45 min postmortem were cut into 0.5×0.5×1.0 pieces, promptly frozen in isopentane cooled by liquid nitrogen, and stored at -80□ until subsequent analysis. Serial transverse muscle sections (10 ㎛) were stained for myo fibrillar ATPase reactivity after acid preincubation (pH4.7) All histochemical samples were examined by an image analysis system (Image-Pro Plus, Media Cybernetics, U.S.A.) and calculated fiber size, number and fiber type composition.

Statistical analysis

Descriptive statistics were performed using the MEANS procedure of the SAS PC software (SAS, 2001) to calculate mean values and standard deviations for all variables. A General Linear Model (SAS, 2001) was used to evaluate significant differences (P<0.05) were detected of MR, QC, and MR×QC. When significant difference (P<0.05) were detected, the mean values were separated by the probability difference (PD-IFF) option at a predetermined probability rate 5%.

III. RESULTS AND DISCUSSION

Histochemical analysis was performed to analyze the qualitative characteristics among candidate boars. Upper group 20% (MK001 & MK003) and lower group 20% (MS001 & MK002) which are excellent in histochemical respect were selected and comparative analysis was performed for histochemical analysis. As the analysis results, it showed the similar values regarding carcass weight, backfat thickness, temperature and etc., but there existed the differences between pH, brightness, drip loss, cooking loss and hardness. The upper group 20% (MK001, MK003) was higher than the lower group 20% (MS001 & MK002) by pH45min & 24hour and it showed the darker color regarding brightness as well ($P < 0.05$). The upper group 20% (MK001, MK003) was superior to the lower group 20% (MS001 & MK002) regarding drip loss and cooking loss and received the better evaluation regarding meat color ($P < 0.05$) as well. The upper group 20% (MK001, MK003) showed the higher result than the lower group 20% (MS001 & MK002) regarding the comparative analysis of hardness and chewiness that express the feeling when eating the meat as well ($P < 0.05$).The upper group 20% (MK001, MK003) which had more number of muscle fibers than the lower group 20% (MS001 & MK002) had the higher in pH, good meat color and excellent drip loss. And, it was excellent regarding cooking loss and hardness as well ($P < 0.05$).

Tablel 1. Meat texture and sensory evaluation classified by Performance group.

Measurements	High Performance		Low Performance		Significance[1)]
	MK 001	MK 003	MS 001	MK 002	
Carcass weight (kg)	77.14[a] (5.48)	78.00[a] (7.41)	79.73[a] (10.6)	77.95[a] (8.66)	NS
Muscle pH24hr	5.78[a] (0.11)	5.69[b] (0.12)	5.68[b] (0.11)	5.61[b] (0.10)	**
Lightness (L*24hr)	43.74[c] (3.5)	46.4[b] (2.8)	47.83[ab] (2.6)	49.20[a] (2.9)	***
Redness (a*24hr)	6.84[a] (1.2)	7.07[a] (1.4)	6.96[a] (1.0)	6.60[a] (1.3)	NS
Yelloness (b*24hr)	4.20[a] (1.4)	3.92[ab] (1.5)	3.32[ab] (1.1)	2.92[b] (1.2)	*
Drip loss(%)	3.68[b] (1.0)	3.63[b] (0.79)	5.00[a] (0.86)	5.37[a] (1.43)	***
Cooking loss (%)	22.06[a] (10.1)	14.18[b] (9.2)	9.28[b] (7.12)	11.82[b] (8.2)	**
Hardness	42.38[a] (4.87)	36.84[b] (6.33)	36.67[b] (8.01)	32.98[b] (4.53)	***

[1)]Measn: NS, Not Significant; *P < 0.05; **P < 0.01.
[a,b] Means (SD) with different superscripts in the same row significantly differ (P < 0.05).

It showed the similar result with the result announced by Lee [5] analyzing the number &

growth of muscle fibers and meat quality of carcass that the group with more number of muscle fibers was superior regarding growing performance and producing performance of lean-meat. As the result of performing comparative measurement against muscle fiber area for histochemical analysis, it showed significant difference slightly, but the measured value of muscle fiber area of Type Ⅰ and Type Ⅱb turned out to be large in the lower group. But, regarding muscle fiber number percentage & muscle area number percentage, the measured value turned out to be higher at the upper group than the lower group. It was measured that the lower group 20% (MS001 & MK002) showed the higher values regarding whole size of muscle fiber, size & density of Type Ⅱb, but the upper group 20% (MK001 & MK003) showed the higher values regarding size & density of Type Ⅰ. It showed the identical tendency with the research results of Lee [5] that says that the number of muscle fibers was in inverse proportion with size of muscle fiber and the density of muscle fiber was in direct correlation with the number of muscle fibers.

Table 2. Muscle fiber type characteristics by Performance groups

Measurements (μm^2)	High Performance		Low Performance		Significance[1)]
	MK 001	MK 003	MS 001	MK 002	
Mean area	4799[a] (846)	4846[a] (968)	5374[a] (1048)	5495[a] (1156)	NS
Type I area	3332[a] (546)	3004[a] (572)	3536[a] (891)	3374[a] (696)	NS
Type II area	3208[a] (690)	3045[a] (518)	3063[a] (995)	3194[a] (932)	NS
Type IIb area	3208[a] (1062)	5467[a] (1229)	5992[a] (1266)	6023[a] (1316)	NS

[1)]Measn: NS, Not Significant; *P < 0.05
[a,b] Means (SD) with different superscripts in the same row significantly differ (P < 0.05).

Table 3. Muscle fiber type ratio by Performance groups

Measurement	Fiber area percentage			Fiber number percentage		
	Type I	Type IIa	Type IIb	Type I	Type IIa	Type IIb
MK 001	13.25[a] (2.13)	5.97[a] (2.19)	80.77[b] (2.18)	19.05[a] (2.97)	9.00[a] (3.15)	71.93[b] (4.53)
MK 003	9.36[b] (2.15)	6.00[a] (2.34)	84.62[c] (0.72)	15.13[b] (3.82)	9.38[a] (2.91)	75.47[c] (2.81)
MS 001	7.87[c] (1.57)	5.31[ab] (1.69)	86.80[b] (0.31)	12.34[c] (3.49)	9.49[a] (2.96)	78.16[b] (3.87)
MK 002	6.68[c] (1.41)	4.35[b] (1.33)	88.95[a] (1.42)	10.93[c] (2.66)	7.74[a] (2.62)	81.32[a] (3.11)
Significance[1)]	***	*	***	***	NS	***

[1)]Measn: NS, Not Significant; *P < 0.05; ***P < 0.001.
[a,b,c]Means (SD) with different superscripts in the same column significantly differ (P < 0.05).

As the analysis results, it showed the similar values regarding carcass weight, backfat thickness, temperature and etc., but there existed the differences between pH, brightness, drip loss, cooking loss and hardness. The upper group 20% (MK001, MK003) was higher than the lower group 20% (MS001 & MK002) by pH45min & 24hour and it showed the darker color regarding brightness as well (P < 0.05). The upper group 20% (MK001, MK003) was superior to the lower group 20% (MS001 & MK002) regarding drip loss and cooking loss and received the better evaluation regarding meat color (P < 0.05) as well. The upper group 20% (MK001, MK003) showed the higher result than the lower group 20% (MS001 & MK002) regarding the comparative analysis of hardness and chewiness that express the feeling when eating the meat as well (P < 0.05). The upper group 20% (MK001, MK003) which had more number of muscle fibers than the lower group 20% (MS001 & MK002) had the higher in pH, good meat color and excellent drip loss. And, it was excellent regarding cooking loss and hardness as well (P < 0.05).
It showed the similar result with the result

announced by Lee [5] analyzing the number & growth of muscle fibers and meat quality of carcass that the group with more number of muscle fibers was superior regarding growing performance and producing performance of lean-meat.

IV. CONCLUSION

As the results of this study there were huge differences regarding growth characteristics and growth performance of the progeny black piglets produced from cross combination of candidate boars depending on performance control and raising environment of the farms. It is judged that the profits of farms can be produced by selecting the excellent breeding pig whose capability of producing good meat quality and the excellent breed and cross combination can be selected continuously by registering, preserving and improving the excellent breeding pig through that.

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