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Comparison of Meat Quality and Composition for Longissimus Muscle Tissues from Gaoligongshan Pig and Saba x Gaoligongshan Cross Pig

[1]Zhao Guiying, [1]Duan Bofang, [2]Duan Xingquan and [2]Ji Xiaorui
[1]College of Animal Science and Technology, Yunnan Agricultural University, 650201 Kunming, China
[2]Animal Husbandry and Veterinary Bureau of Lushui, 673200 Nujiang, China

Abstract: The differences of meat quality and composition of longissimus muscle tissues from Gaoligongshan pig and Saba x Gaoligongshan cross pig were evaluated and results showed that significant difference was found in the meat color value, drip loss rate, cooked meat ratio, crude protein content, crude ash content, percentage of heptadecanoic acid, stearic acid, linolenic acid, eicosatetraenoic acid, saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, aspartate, threonine, serine, glutamic acid, glycine, valine, alanine, methionine, isoleucine, leucine, lysine, histidine, arginine, proline, palatable taste amino acid and essential amino acid between the animals of Gaoligongshan pig and Saba x Gaoligongshan cross pig ($p<0.05$). These data established the foundation for further utilization of these two Yunnan local pig breeds: Saba pig and Gaoligongshan pig.

Key words: Yunnan local pig, Saba pig, Gaoligongshan pig, comparison, meat quality, China

INTRODUCTION

Chinese indigenous pig breeds such as Meishan, Erhualian and Tongcheng often have valuable traits such as disease resistance, high fertility, good maternal qualities, good meat quality, unique product qualities, longevity and adaptation to harsh conditions. Exotic pig breeds such as Large White, Landrace, Duroc possess the good achievements in growth rate, high lean rate especially, the introduced pigs have higher lean meat rate and food conversion efficiency whereas Chinese indigenous pigs have more fat deposition and superior meat quality (Pan *et al*., 2003; Liu and Xiong, 2009a, b).

Yunnan province is located in Southwest China and has six representative local pig breeds; Saba pig, Tibetan pig, Gaoligongshan pig, Diannan small-ear pig, Wujin pig and Baoshan pig. These six representative local pig breeds also have the common characteristics of Chinese indigenous pig breeds such as good meat quality.

In the present experiment, researchers will compare the meat quality and composition of longissimus muscle tissues from Gaoligongshan pig and Saba x Gaoligongshan cross pig. These will serve as a foundation for further utilization of these two Yunnan local pig breeds; Saba pig and Gaoligongshan pig.

MATERIALS AND METHODS

Animals and sample treatment: Six 300 days old Gaoligongshan pigs and six 300 days old Saba x Gaoligongshan cross pigs were slaughtered in January, 2011. The longissimus dorsi muscle samples were collected and would be used to perform meat quality analysis.

The traits of meat quality and composition of longissimus muscle tissue such as drip loss rate, muscle pH, meat marbling score, meat color value, cooked meat ratio, store loss rate, crude fat content, crude protein content, moisture content and dry matter content were also measured and recorded according to the method of Xiong and Deng (1999). The muscular amino acid content was analyzed using the Hitachi 835-50 amino acid high speed analyzer (Hitachi Instruments, Japan). The intramuscular fatty acid content was analyzed using the gas chromatograph (Hitachi Instruments, Japan) following the user manual.

Statistical analyses: The statistical significance of differences between means was assessed using the least square method (GLM procedure, SAS Ver. 8.0). The model used to analyze the data was assumed to be:

Corresponding Author: Zhao Guiying, College of Animal Science and Technology, Yunnan Agricultural University, 650201 Kunming, China

$$Yik = \mu+Si+Gk+bikXik+eik$$

Where:

Yik = The observation of the trait
μ = The least square mean
Si = The effect of its sex (i = 1 for male or 2 for female)
Gk = The effect of group (j = 1, 2)
bik = The regression coefficient of the slaughter weight
Xik = The slaughter weight
eik = The random residual

RESULTS AND DISCUSSION

Meat quality of longissimus muscle tissues: Through analyzing of the meat quality of longissimus muscle tissues from Gaoligongshan pigs and Saba x Gaoligongshan cross pigs, it could be found that the meat color value and drip loss rate of Saba x Gaoligongshan cross pig was decreased by 0.38 ($p<0.05$) and 4.92% ($p<0.05$), respectively. The cooked meat ratio of Saba x Gaoligongshan cross pig was increased by 8.27 ($p<0.05$). For the store loss rate, meat marbling and meat pH, no significant difference was found between animals of Gaoligongshan pig and Saba x Gaoligongshan cross pig. These statistic results are shown in Table 1.

Main chemical composition of longissimus muscle tissues: Through comparing the main chemical composition of longissimus muscle tissues from Gaoligongshan pig and Saba x Gaoligongshan cross pig, it can be seen that Gaoligongshan pigs had the higher crude protein content ($p<0.05$) and crude ash content ($p<0.05$) than the Saba x Gaoligongshan cross pigs. These statistic results are showed in Table 2.

Fatty acids composition of longissimus muscle tissues: By analyzing the fatty acids composition of longissimus muscle tissues from Gaoligongshan pig and Saba x Gaoligongshan cross pig, it can be seen that the percentage of heptadecanoic acid, stearic acid, saturated fatty acids of Saba x Gaoligongshan cross pig were significantly increased ($p<0.05$) compared to that of Gaoligongshan pig. It can also be seen that the percentage of linolenic acid, eicosatetraenoic acid and monounsaturated fatty acids, polyunsaturated fatty acids were significantly decreased ($p<0.05$) compared to that of Gaoligongshan pig. These statistic results are shown in Table 3.

Amino acids composition of longissimus muscle tissues: Through comparing the amino acids composition of longissimus muscle tissues from Gaoligongshan pig and Saba x Gaoligongshan cross pig, it can be seen that compositions of aspartate, threonine, serine, glutamic acid, glycine, valine, alanine, methionine, isoleucine, leucine, lysine, histidine, arginine, proline, palatable taste amino acid and essential amino acid of Saba x Gaoligongshan cross pig were obviously higher than that of Gaoligongshan pig ($p<0.05$). For the tyrosine and phenylalanine composition, no significant difference was found between the animals of Gaoligongshan pig and Saba x Gaoligongshan cross pig. These statistic results are shown in Table 4.

Through meat quality analysis, it could be seen that the Saba x Gaoligongshan cross pig has the lower drip loss rate, higher cooked meat ratio and higher compositions of aspartate, threonine, serine, glutamic acid, glycine, valine, alanine, methionine, isoleucine, leucine, lysine, histidine, arginine, proline, palatable taste amino acid and essential amino acid than Gaoligongshan pig. This implied Saba x Gaoligongshan cross pig had better partialmeat quality traits and better partial amino acids composition than the Gaoligongshan pig.

Based on the results of comparing the main chemical composition and fatty acids composition of longissimus muscle tissues, it can be seen that Gaoligongshan pigs had the higher crude protein content, crude ash content and percentages of linolenic acid, eicosatetraenoic acid and monounsaturated fatty acids, polyunsaturated fatty

Table 1: Comparison of the meat quality of longissimus muscle tissues from Gaoligongshan pig and Saba x Gaoligongshan cross pig

Breed	Meat color value	Meat marbling	Cooked meat ratio (%)	Store loss rate (%)	Drip loss rate (%)	Meat pH
Gaoligongshan pig	3.38±0.10[a]	3.58±0.100[a]	59.35±0.93[a]	3.74±0.07[a]	15.29±0.29[a]	6.49±0.14[a]
Saba x Gaoligongshan cross pig	3.0±0.000[b]	3.38±0.125[a]	67.62±4.07[b]	3.88±0.42[a]	10.37±1.09[b]	6.20±0.04[a]

Table 2: Comparison of the main chemical composition of longissimus muscle tissues from Gaoligongshan pig and Saba x Gaoligongshan cross pig

			Content		
Breed	Dry matter (%)	Moisture (%)	Crude protein (%)	Crude fat (%)	Crude ash (%)
Gaoligongshan	31.68±0.27[a]	68.32±0.27[a]	22.25±0.26[a]	7.08±0.12[a]	1.10±0.02[a]
Saba x Gaoligongshan cross	30.9±0.530[a]	69.1±0.530[a]	20.88±0.23[b]	8.45±0.71[a]	0.79±0.02[b]

Data in the table are least square means±standard error. Values in each row with different small letters are significantly different at $p<0.05$

Table 3: Comparison of the fatty acids composition of longissimus muscle tissues from Gaoligongshan pig and Saba x Gaoligongshan cross pig

Fatty acid type (%)	Gaoligongshan pig	Saba x Gaoligongshan cross pig
Octanoic acid	0.005±0.001[a]	0.014±0.002[a]
Capric acid	0.034±0.002[a]	0.051±0.006[a]
Dodecanoic acid	0.035±0.004[a]	0.046±0.003[a]
Myristic acid	1.397±0.122[a]	1.435±0.037[a]
Pentadecanoic acid	0.017±0.008[a]	0.033±0.005[a]
Palmitic acid	23.143±1.137[a]	26.080±0.557[a]
Heptadecanoic acid	0.175±0.035[a]	0.368±0.036[b]
Stearic acid	11.893±1.326[a]	16.363±0.305[b]
Nonade-canic acid	0.017±0.007[a]	0.030±0.007[a]
Oleic acid	43.974±2.443[a]	42.848±0.727[a]
Linoleic acid	11.604±2.117[a]	6.925±0.276[a]
Linolenic acid	1.342±0.210[a]	0.298±0.050[b]
Arachidic acid	0.367±0.027[a]	0.368±0.035[a]
Eicosadienoic acid	0.426±0.056[a]	0.300±0.045[a]
Eicosatrienoic acid	0.038±0.007[a]	0.030±0.006[a]
Eicosatetraenoic acid	0.967±0.153[a]	0.093±0.020[b]
Saturated fatty acids	37.082[a]	44.787[b]
Monounsaturated fatty acids	49.651[a]	47.568[b]
Polyunsaturated fatty acids	14.376[a]	7.646[b]

Table 4: Comparison of the amino acids composition of longissimus muscle tissues from Gaoligongshan pig and Saba x Gaoligongshan cross pig

Amino acid type (%)	Gaoligongshan pig	Saba x Gaoligongshan cross pig
Aspartate	1.215±0.045[a]	1.87±0.0230[b]
Threonine	0.61±0.0300[a]	0.915±0.010[b]
Serine	0.515±0.025[a]	0.76±0.0080[b]
Glutamic acid	1.815±0.065[a]	2.86±0.0380[b]
Glycine	0.625±0.005[a]	0.843±0.017[b]
Alanine	0.815±0.025[a]	1.188±0.013[b]
Valine	0.695±0.015[a]	1.005±0.016[b]
Methionine	0.17±0.0100[a]	0.435±0.019[b]
Isoleucine	0.675±0.015[a]	1.025±0.016[b]
Leucine	1.08±0.0500[a]	1.613±0.018[b]
Tyrosine	0.36±0.0500[a]	0.593±0.011[a]
Phenylalanine	0.525±0.025[a]	0.758±0.008[a]
Lysine	1.17±0.0400[a]	1.753±0.018[b]
Histidine	0.59±0.0400[a]	0.888±0.017[b]
Arginine	0.785±0.025[a]	1.18±0.0140[b]
Proline	0.52±0.0200[a]	0.738±0.020[b]
Palatable taste amino acid	4.965±0.105[a]	7.413±0.084[b]
Essential amino acid	4.925±0.185[a]	7.503±0.079[b]

Data in the table are least square means±standard error. Values in each line with different small letters are significantly different at $p<0.05$

acids than the Saba x Gaoligongshan cross pigs. To this aspect, Gaoligongshan pig has the desirable traits. So that when researchers can use the Saba pig to cross the Gaoligongshan pig to improve the some meat quality traits and composition of longissimus muscle tissues for Gaoligongshan pig in the pig production, researchers must give full consideration to these two things.

CONCLUSION

In this study, researchers compared the meat quality and composition of longissimus muscle tissues from Gaoligongshan pig and Saba x Gaoligongshan cross pig. These established the foundation for further utilization of these two Yunnan local pig breeds: Saba pig and Gaoligongshan pig.

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