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Production Performance, Slaughtering and Meat Quality of Different Breed Pigs

Guoshun Chen*, Shengzhang Shui, Yu Cai, Liu Na and Yingyu Su

College of Animal Science and Technology, Gansu Agricultural University, Lanzhou 730070, P. R. China

Abstract

In the test to select hybrid F1 generation of wild boar (wild boar ♂ × BAM ♀), local pig breeds (BAM and HZP) and YOK were adopted single factor experimental design, under the same nutrient levels, production performance, slaughter performance and meat quality characteristics of different varieties of pigs were studied. The results showed that a daily gain of F1 and BAM were significantly lower than YOK ($P<0.05$), while daily gain of HZP was significantly lower than another groups ($P<0.01$), and YOK fed remuneration and lean meat were the highest. Slaughter rate, carcass length, pH, water loss rate, storage loss and muscle fiber diameter of HZP were relatively lower, but meat score and marble texture were relatively higher. From AA and FA contents of the muscle, the pig's main UAA content of HZP was 23.91 g, accounting for 34.50% of the total AA contents, second only to the F1 hybrid, and the content of UFA was the highest, and UFA/SFA was 1.30. Compared with another breeds of pigs, HZP had good meat quality, The compounds which may contribute to the flavor of pork were 3-methyl-1-butanol, 1-nonanal, Octanal, Hexanal, 2-pentyl-furan, 1-penten-3-one, N-morpholinomethyl-isopropyl-sulfide, Methyl butyrate and (E,E)-2,4-decadienal. In conclusion, the volatile compounds in pork belong to several classes and the highest relative amount of volatile compounds was found in BAM.

Keywords: Wild boar; Hybrid combination; Meat quality; Growth performance; Slaughter performance; Volatile compounds; Flavor

Introduction

Pork is an important part of the human diet. With the improvement of living standard and strengthening awareness of diet and health, people pay more and more attention to the sensory quality and health careful function of animal production. Therefore, at the same time of guaranteeing health security and high lean pork production, how to improve the sensory quality of pork and produce high quality pork has become the urgent task of modern pig production. The genotype, nutrition, stress before slaughter, and the carcass fast cooling, which can affect the meat quality [1]. The quality of the pork has already become an important subject of collaborative research and concern in the field of the world pig science, meat science, animal genetics and breeding, feed industry and so on. The research results showed that there were many influencing factors in meat quality, but the main influence factors of meat quality are the improving varieties (genetic control) and nutritional regulation, and breed is the decisive factor. In this experiment, hybrid F1 generation of wild boar, local pig breeds (BAM and HZP) and YOK were selected, feeding in Gansu Liuhe Ecological Pig Farm, which aimed to explore difference in production performance, slaughter performance and meat quality characteristics of four breeds of pigs could provide the basic material for different varieties of pigs in-depth study.

Materials and Methods

Materials and design

Four breeds of pigs, including hybrid F1 generation of wild boar (wild boar ♂ × BAM ♀), BMA, YOK and HZP were divided into 4 groups, 8 heads each group, the half of male and female, raised in Gansu Liuhe Ecological Pig Farm. 6 pigs were chosen to slaughter from each group. Back longest muscle specimens of the bottom of the first and second ribs would be done meat quality analysis.

The experimental pigs were fed for 100 days. During this period we sprayed insecticides and injected vaccinations, giving experimental pigs ear number, adjusted the housing and calculated feeding density. The experimental pigs were fed 3 times a day and free to drink water. We recorded feeding consumption, weighted on an empty stomach every Monday at 8 o'clock in the morning, drawing weighted graph, calculating the average daily feed intake, daily gain and feed conversion ratio of experimental pigs. The local animal care and useful committee approved all experimental protocols.

Experimental diets

Reference the NRC growth, fattening pigs mixture compound feed nutritional needs. The diet composition and the main nutrients are shown in Table 1 [2].

Experimental methods

Slaughter scheme: Before slaughtering, pigs were fasted for 24 h but free to drink. Then they were weighted. The slaughter process was conducted in Gansu Liuhe Ecological Pig Farm. According to conventional slaughter methods, we removed the head, hooves and viscera (keeping suet). Next weighting left carcass, we measured skin thickness, back fat thickness and carcass length according to the skin, fat, muscle and bone. Then we calculated lean meat, fat and lean meat rate etc. Finally, the meat samples were sealed by plastic bags for analyzing the quality of pork [3].

The determination of meat characteristics: This program was carried out according to the second session of the national pork quality and the research experience exchange correction scheme "pork quality and the

***Corresponding author:** Guoshun Chen, College of Animal Science and Technology, Gansu Agricultural University, Lanzhou 730070, P. R. China, Tel: 0931-7632600; E-mail: chengs@gsau.edu.cn

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Item	15-30 kg	30 kg-	Item	15-30 kg	30 kg-
Corn /%	56	58.2	DE /Kcal·kg^{-1}	3050	3000
Wheat bran /%	13	15	CP /%	16.12	14.41
Corn hulls /%	2	3	Fat /%	3.06	2.93
Soybean meal /%	14	10	CF /%	3.4	3.65
Rapeseed meal /%	3.9	5	DM /%	81.02	80.14
Beet meal /%	2	2	Ash /%	4.83	4.6
Barley malt sprouts /%	3	3	Ca /%	0.86	0.72
Fish meal /%	3	1	TP /%	0.66	0.6
Premix /%	1	1	Salt /%	0.49	0.38
Limestone /%	0.7	0.6	Ca /P	1.3	1.2
$CaHPO_4$ /%	1.1	0.9			
Salt /%	0.3	0.3			

Table 1: Diet composition and the nutrient levels of test pigs.

determination method". The longissimus muscle at 1-2 lumbar of the left half carcass was taken as materials for determining meat quality. The determination of indicators are as follows.

- Meat color: contrast with 5-point standard sample paper and score;
- The pH: after the slaughter of 45 min, measuring with pH meter;
- Marble texture: determination in the same method as meat color;
- Water loss rate: determination by pressure gauge, pressure of 35 kg, for 5 min;
- Tenderness was measured by tenderometry determined to five times the average of the shear;
- Cooked meat rate: the cooked method.

Determination of conventional indicators of meat samples

- Crude protein determination: semi-micro Kjeldahl determination;
- Fat measurement: Soxhlet extraction method;
- Moisture: 105°C oven drying method;
- Crude ash measurement: 550°C Ashing furnace;
- Determination of calcium and phosphorus: refer GB 12398-90,12393-90.

Analysis of FA: Gas chromatographic analysis of free FA [4]. Gas chromatographic conditions: Column temperature: 210°C. Injector temperature: 280°C. Detector temperature: 280°C. Nitrogen flow rate: 40 ml/cm^2.

Analysis and evaluation of AA: Pre-treatment of the sample by hydrochloric acid hydrolysis method: The sample drying (with moisture) → cooling →after cooling skim with Soxhlet extraction method, weighing the sample and putting it into a test tube → joining 6 mol/L hydrolysis / hydrochloric acid into the evaporating dish, steaming→ dry → constant volume and filtration, machine analysis (HPLC assay).

Evaluation methods: The EAA content of pig muscle measured (representing dry sample) divided by 16, which is converted into N milligrams per gram of AA, and the 1993 WHO/FAO (WHO / FAO) [5] the EAA score criteria and compare the muscle protein [6], AA score and chemical points is calculated as follows:

AA score=AA content of protein to be evaluated (mg. gN^{-1}) / AA content of FAO score (mg. gN^{-1});

Chemical score=AA content of protein to be evaluated (mg. gN^{-1}) / AA content of egg protein (mg. gN^{-1})

Determination of longissimus muscle fiber characteristics: Fiber diameter with 10% formalin-fixed, paraffin-embedded HE staining, set 10 × 10 grid micrometer microscope to count two random grid to determine the ratio of the density of the muscle fibers and then micrometer measuring muscle fiber diameter.

Data analysis

Experimental data were conducted with statistical software *SPSS 19.0* One-Way ANOVA and Duncan Multiple Comparisons.

Experimental Results and Analyses

Production performance of different breeds of pigs

Seen from Table 2, in the four experimental groups, ADG of F1 group and BAM group were significantly lower than Y ($P<0.05$), while the ADG of HZP group was significantly lower than the another groups ($P<0.01$), which was small breed pigs, short body itself relevant. Feed conversion ratio of HZP group was significantly higher than YOK group ($P<0.05$), and reached the highest level of 3.51:1, sorted in descending order that is: HZP>F1>BAM>YOK. YOK has the highest feed reward because of external breeds, and HZP has a minimum in growing and finishing pigs performance above breeds pigs, HZP does not belong in the same grade, the purpose of the study is conducive to the growth of co-depth knowledge of the pig.

Slaughter Performance of different breeds of pigs

Carcass traits of different breeds of pigs: From Table 3, HZP is a small breed pigs, their slaughter rate, carcass length were significantly smaller than the another groups was ($P<0.01$). There was no significant difference between the groups in backfat thickness, but from the phenotypic value analysis, blackfat thickness of HZP group was the thinnest and BAM group was the thickest, F1 group and YOK group were closer. Thick-skinned of F1 group was significantly greater than YOK group and HZP group ($P<0.05$). From the loin eye area, the YOK group is significantly greater than F1 group ($P<0.05$), but significantly larger than the HZP groups ($P<0.01$). The legs ratio of each group was no significant difference from the analysis of phenotypic values, the highest F1 group was 33.0%, which is related to the wild boar living in the bush, with developed hindquarters, but it needs further study to determine.

Group	Sample number	Feeding days	Initial weight	Final Weight	Average gain	Feed efficiency
F1	8	100	12.40 ± 4.43	47.57 ± 14.98^{b}	401.71 ± 15.65^{Ab}	3.47
BAM	8	100	13.09 ± 3.50	67.50 ± 12.20	544.10 ± 21.74^{Ab}	3.41
YOK	8	100	13.96 ± 1.18	88.74 ± 3.65^{Aa}	747.80 ± 20.30^{Aa}	3.36^{b}
HZP	8	100	7.63 ± 1.53	39.98 ± 7.02^{B}	210.01 ± 16.43^{B}	3.51^{a}

Note: 1. Different capital letters in the table mean P<0.01; different small letters in the table mean P<0.05.

2. Slaughtered of H weighs 40 kilograms, donating H here. The following is the same.

Table 2: Production performance of different breeds of pigs % kg g/d.

Group	Sample number	Percentage of dressed weight	Carcass Length	Black fat thickness	Skin thickness	Eye-muscle area	Ratio of hindquarter
F1	6	70.83 ± 1.83^{A}	65.60 ± 3.36^{Ab}	2.71 ± 0.22	0.34 ± 0.03^{a}	38.69 ± 4.78^{b}	33.00 ± 2.46
BAM	6	74.00 ± 1.23^{A}	80.05 ± 4.76^{A}	3.13 ± 0.43	0.30 ± 0.02	39.78 ± 4.96	30.80 ± 3.38
YOK	6	75.63 ± 1.89^{A}	82.12 ± 3.11^{Aa}	2.78 ± 1.12	0.24 ± 0.06^{b}	47.34 ± 7.62^{Aa}	29.70 ± 5.95
HZP	6	66.13 ± 2.41^{B}	47.50 ± 2.12^{B}	2.50 ± 0.33	0.22 ± 0.01^{b}	18.64 ± 3.04^{B}	31.56 ± 3.75

Table 3: Carcass traits of different breeds of pigs slaughtered % cm cm^{2}.

Slaughter performance of different breeds of pigs: As is seen in Table 4, YOK group has the highest lean rate, reaching 63.26%, while BAM group was the lowest, being only 55.64%. These were contrary trends between fat rate and lean rate, not significant difference between groups (P>0.05). The difference between bone rate and skin rate was not significant (P>0.05), but skin rate of HZP was the highest (10.05%). In addition to skin rate, bone rate and fat rate of HZP, another character were not statistically significant compared with another breed of pigs, because its size is too small to fit them together. Left kidney weight and spleen weight of F1 group were significantly lower than BAM group and YOK group (P<0.01). Tail weight of YOK group was significantly greater than the F1 group and BAM group (P<0.01), and the head weight of YOK group was significantly greater than F1 group (P<0.05).

Meat quality of different breeds of pigs

As is seen in Table 5, the pH of each group has no significant difference (P>0.05), pH of F1 group was the lowest, being 5.74. Water loss rate of HZP group and F1 group were significantly smaller than the rest of groups (P<0.01), while the differences between the groups were not significant (P>0.05). Flesh score of HZP group and F1 group was significantly higher than YOK group (P<0.05). Marbling score of HZP group and BAM group were significantly higher than YOK group and F1 group (P<0.05). Flesh score, marbling score of HZP group, BAM group and F1 group were higher than YOK group, but the observation with a subjective consciousness, the further studies need to adopt new methods. Cooked rates in each group had no significant difference (P>0.05). Storage losses of YOK group was significantly higher than F1 group and BAM group (P<0.05), it was significantly higher than HZP group (P<0.01), which showed that local pigs and wile pigs had better water holding ability, especially HZP showed good meat characteristics. The fat of BAM group was significantly higher than the another groups (P<0.05). Muscle fiber diameter was no significant differences among the groups (P>0.05), muscle fiber diameter of HZP was the smallest, as 37.04 μm, various another breeds of pigs were higher than 40.0 μm, which is the highest F1 group, up to 48.55 μm, followed by YOK group, as 44.17 μm.

Effect on AA in the muscle of different breeds of pigs

Composition of AA in the muscle of different breeds of pigs: The 18 kinds of AA was determined by this study (Table 6), total AA per 100 g dry weight of F1 group was the highest (77.61 g), followed BAM group (73.39 g), YOK group was the lowest (68.03 g) and another groups were more than 70.0 g. Glutamate content in each group was the highest, followed by Aspartic acid and Threonine. The main flavor AA of F1 group was the highest, reaching 27.85 g (35.88% of total AA content), followed by HZP group, 23.91 g (34.50% of total AA content), while YOK group was the lowest (30.50%). In contrast, Proline and Alanine of F1 group and Methionine and Glycine of BAM group were the highest in the whole groups. Isoleucine, Leucine, Lysine, Methionine+Cystine, Phenylalanine+Tyrosine, Threonine, Tryptophan, Valine and another 10 kinds of AA are necessary for the body, the total AA of Y group among the EAA was the highest, reaching 45.29%, but the total AA content is only 68.03 g/100 g dry weight.

Quality evaluation of different breeds of EAA in pig muscle: A kind of higher nutritional value of food protein not only contains EAA to complete, but also must have the appropriate proportion within AA. It is preferably close to or in line with the body's needs, so the absorption of the EAA will be more complete, and has a higher nutritional value. Nutritional value of food protein is mainly determined by the level of the type, quantity and composition of the AA contained. FAO/WHO scoring models of egg protein as the standard, calculated with different breeds of pigs points and chemistry of AA in Table 7, points of view from each group of AA, each test group except Methionine+Cystine, Styrene+Tyrosine. Threonine, Tryptophan and Isoleucine, the remaining AA points were less than 1.00. Tryptophan was about 1.00 points. And sulfur-containing AA and Threonine had higher nutritional value. In addition to the chemical of Methionine+Cystine and Threonine, the rest of the AA were lower than 1.0. Sulfur-containing AA of Y group and BAM group were less than 1.00. In addition, from the point of view of each group of AA, the first limited AA of Y group and BAM group were Lysine, the first limited AA of HZP group and F1 group were Leucine.

Group	F1	BAM	YOK	HZP
Percentage of lean meat	62.27 ± 3.39	55.64 ± 3.71	63.26 ± 6.19	56.56 ± 1.66
Percentage of fat	20.55 ± 0.60	28.93 ± 2.28	20.91 ± 3.29	18.86 ± 10.58
Percentage of bone	9.74 ± 1.15	6.42 ± 0.49	7.91 ± 1.98	8.47 ± 0.19
Percentage of skin	7.44 ± 2.81	9.01 ± 0.40	7.92 ± 1.41	10.05 ± 2.19
Stomach wt.	440.59 ± 56.79	784.50 ± 37.89	685.00 ± 74.29	278.00 ± 15.66
Liver wt.	833.33 ± 90.18	1332.25 ± 52.03	997.50 ± 42.73	863.50 ± 26.34
Heart wt.	275.33 ± 17.11	334.50 ± 23.17	325.00 ± 18.27	165.00 ± 27.71
Kidney wt.	75.00 ± 5.00^{B}	126.25 ± 3.15^{A}	105.00 ± 8.07^{A}	72.00 ± 11.31
Lung wt.	975.00 ± 98.05	847.50 ± 22.32	727.50 ± 19.19	417.50 ± 37.89
Spleen wt.	71.67 ± 5.58^{B}	156.50 ± 3.91^{A}	195.00 ± 12.15^{A}	55.25 ± 7.42
Head wt.	4.94 ± 0.10^{b}	6.58 ± 0.12	7.78 ± 1.02^{a}	2.57 ± 0.12
Feet wt.	1.022 ± 0.10	1.16 ± 0.14	1.43 ± 0.31	0.57 ± 47.07
Tail wt.	68.33 ± 3.09^{B}	67.00 ± 6.58^{B}	135.00 ± 21.00^{A}	70.00 ± 7.07
Small intestine length	14.72 ± 0.87	15.86 ± 1.45	13.77 ± 0.70	11.29 ± 1.01
large intestine length	4.63 ± 0.23	5.09 ± 0.36	3.81 ± 0.17	5.12 ± 0.21
Percentage of Intestine fat	6.46 ± 1.44	6.32 ± 1.05	8.68 ± 2.09	3.59 ± 0.65
Percentage of kidney fat	3.74 ± 0.51	4.87 ± 0.98	6.36 ± 1.65	6.12 ± 0.76

Table 4: Slaughter performance of different breeds of pigs % g kg m.

Group	F1	BAM	YOK	HZP
PH	5.74 ± 0.33	6.13 ± 0.03	6.23 ± 0.17	6.45 ± 0.12
Percentage of water loss /%	30.07 ± 1.58^{A}	32.39 ± 1.04^{A}	34.01 ± 5.54^{A}	10.68 ± 0.73^{B}
Meat color	3.75 ± 0.01^{a}	3.55 ± 0.71	3.00 ± 0.50^{b}	4.00 ± 0.00^{a}
Marbling	2.75 ± 0.35^{b}	4.00 ± 0.14^{a}	2.77 ± 0.29^{b}	3.92 ± 0.04^{a}
Cooking rate /%	69.78 ± 3.58	70.00 ± 4.71	67.98 ± 1.03	70.37 ± 0.87
Storage loss /%	2.09 ± 0.26^{b}	2.78 ± 0.08^{b}	3.35 ± 0.22^{Aa}	1.84 ± 0.12^{B}
Total moisture /%	72.38 ± 0.48	70.10 ± 9.10	74.34 ± 5.46	69.42 ± 3.05
Crude Protein /%	22.10 ± 0.04	22.28 ± 1.17	20.78 ± 3.96	24.32 ± 0.49
Crude Fat /%	3.01 ± 0.34^{b}	6.34 ± 2.43^{a}	3.46 ± 2.15^{b}	3.71 ± 0.27^{b}
Crude Ash /%	1.20 ± 0.11	0.95 ± 0.07	1.11 ± 0.24	1.49 ± 0.18
Ca /%	0.05 ± 0.01	0.05 ± 0.01	0.06 ± 0.01	0.16 ± 0.02
P /%	0.21 ± 0.01	0.23 ± 0.01	0.24 ± 0.01	0.33 ± 0.00
Fiber /μm	48.55 ± 6.83	43.19 ± 5.63	44.17 ± 3.32	37.04 ± 1.42

Note: pH value within 45min.

Table 5: Meat quality of different breeds of pigs %.

FA composition of different breeds in pig muscle

The experimental results showed that (Table 8) F1, BAM, YOK and HZP groups had the same composition of FA, OA. The total content of LA, PA and SA have more than 90% of all FA, another FA had lower levels. UFA content of HZP group was the highest, reaching 53.99%, followed by F1 group as 49.42%. The UFA content in total was in order of HZP>F1>BAM> YOK. UFA contents of HZP group were relatively lower, but the UFA / SFA were the highest with 1.30, descending to the F1 group (1.11), and the another pig breeds were less than 1.00. Therefore, muscle of HZP has good quality and high nutritional value, followed by the F1. LA content of HZP group was the highest with 7.61%, followed by F1 group (5.22%), the lowest YOK group was 4.30%.

Comparison of volatile compounds in pork meats from all breeds

Sixty-four volatile compounds were observed in the various pork meats studied, at different amounts (Table 8). BAM showed the highest sum of relative amount (67.991%) of common volatile compounds, followed by HZP (51.463%), YOK (49.172%), and SUS (42.478%). Trimethyl fluorosilane was the most abundant volatile compound in all breeds. Compounds that showed marked differences in their relative amounts included: allyl isobutyrate, (Z)-2-Penten-1-ol, 3-ethyl-2,2-dimethyl-Oxirane, fluoro trimethyl silane, 2-pentyl-furan, D-Lilac alcohol, octanal, dodecane, N-decanoic acid, acetate-1H-indole-3-ethanol, eicosane, 3-methyl-1-butanol, 2-decene-1-ol, and (1-demethyl)-benzene ($P<0.05$). For example, the relative amounts of 2-pentyl-furan were significantly higher in SUS than in BAM, YOK, and HZP ($P<0.05$), while no significant differences were observed among the BAM, YOK, and HZP ($P>0.05$) groups. Interestingly, the relative amounts of D-lilac alcohol, octanal, dodecane, N-decanoic acid, eicosane, 3-methyl-1-butanol, 2-decene-1-ol, and (1-demethyl)-benzene were markedly different among the groups ($P<0.01$). The detailed comparison of all volatile compounds is shown in Table 8.

Discussion

Production performance of different breeds of pigs

Daily gain and feed efficiency of YOK was the highest. Conversely, HZP had the poor of daily gain and feed efficiency, which was with its small breed pigs, short body itself relevant. As to growth fattening performance, HZP does not belong to the same grade with another breeds of pigs, the purpose of the study is conducive to the growth of co-depth knowledge of the pig.

Slaughtered performance of different breeds of pigs

The main basis for judging the quality of the slaughtered performance

Proportion of the total amino acids in proteins	Breeds			
	F1	BAM	YOK	HZP
Threonine[1]	7.98 ± 0.05	7.58 ± 0.03	6.70 ± 0.25	7.44 ± 0.12
Valine [1]	3.11 ± 0.12	3.30 ± 0.20	3.08 ± 0.32	2.83 ± 0.32
Methionine [1]	2.23 ± 0.03	1.81 ± 0.21	1.84 ± 0.22	2.06 ± 0.52
Isoleucine [1]	2.33 ± 0.04	3.41 ± 0.11	3.32 ± 0.01	2.61 ± 0.22
Leucine [1]	2.65 ± 0.12	5.00 ± 0.23	4.85 ± 0.32	3.27 ± 0.42
Phenylalanine [1]	2.56 ± 0.10	3.37 ± 0.01	3.20 ± 0.04	2.61 ± 0.34
Lysine [1]	3.31 ± 0.03	3.50 ± 0.04	3.32 ± 0.01	3.07 ± 0.32
Histidine	5.04 ± 0.06	5.08 ± 0.06	5.04 ± 0.03	4.05 ± 0.22
Tryptophan [1]	0.68 ± 0.11	0.75 ± 0.0	0.69 ± 0.06	0.80 ± 0.12
Arginine	5.30 ± 0.23	5.36 ± 0.04	5.39 ± 0.08	5.07 ± 0.24
Aspartic acid [2]	9.26 ± 0.23	7.19 ± 0.07	6.83 ± 0.09	7.60 ± 0.42
Glycine [2]	4.82 ± 0.13	5.00 ± 0.06	4.85 ± 0.08	4.54 ± 0.23
Glutamic acid [2]	11.5 ± 0.22	8.4 ± 0.03	7.33 ± 0.03	10.51 ± 0.21
Alanine 2	2.26 ± 0.22	1.8 ± 0.05	1.74 ± 0.02	1.26 ± 0.23
Roline	3.63 ± 0.12	2.9 ± 0.06	1.73 ± 0.01	2.92 ± 0.65
Cystine [1]	2.81 ± 0.03	1.7 ± 0.04	1.66 ± 0.05	2.35 ± 0.34
Erine	4.78 ± 0.04	4.38 ± 0.06	4.31 ± 0.05	4.06 ± 0.54
Tyrosine [1]	3.35 ± 0.02	2.56 ± 0.01	2.10 ± 0.03	3.05 ± 0.71
Total content of AA	77.6 ± 0.42	73.3 ± 0.32	68.0 ± 0.42	70.10 ± 0.32
EAA total content	31.0 ± 0.81	33.0 ± 0.52	30.8 ± 0.22	30.09 ± 0.32
EA A/AA total content /%	39.9 ± 0.33	45.0 ± 0.52	45.2 ± 0.42	42.92 ± 0.42
The main UAA total content	27.8 ± 0.31	22.5 ± 0.32	20.7 ± 0.32	23.91 ± 0.23
The main UAA/ total AA content /%	35.8 ± 0.32	30.6 ± 0.42	30.5 ± 0.31	34.50 ± 0.34

Note: "1": EA A, "2": Some A A for meat flavors precursors.

Table 6: Composition of AA in the muscle of different breeds of pigs g/100gDry weight, %.

EAA		Isoleucine	Leucine	Lysine	Met.+Cys.	Phe.+Tyr.	Threonine	Tryptophan	Valine
FAO		250	440	340	220	380	250	60	310
Egg protein		331	534	441	386	565	292	99	411
F1	AA	188	213	267	406	476	643	55	250
	AAS	0.75	0.49	0.78	1.84	1.25	2.57	0.91	0.81
	CS	0.57	0.40	0.60	1.05	0.84	2.20	0.55	0.61
BAM	AA	290	426	298	307	505	646	64	281
	AAS	1.16	0.97	0.88	1.39	1.33	2.58	1.06	0.91
	CS	0.88	0.80	0.68	0.79	0.89	2.21	0.65	0.68
YOK	AA	305	446	305	322	487	620	63	283
	AAS	1.22	1.01	0.90	1.46	1.28	2.48	1.06	0.91
	CS	0.92	0.83	0.69	0.83	0.86	2.12	0.64	0.69
HZP	AA	230	289	271	389	500	657	69	276
	AAS	0.92	0.66	0.80	1.77	1.31	2.63	1.15	0.89
	CS	0.70	0.54	0.61	1.01	0.88	2.25	0.70	0.67

Note: AAS: Amino acid score; CS: Chemical score.

Table 7: Quality evaluation of different breeds of EAA in pig muscle mg.gN^{-1}.

is slaughter rate, lean rate, backfat thickness and another indicators. HZP is as mall, their slaughter rate, carcass length were less than the another breeds of pigs, its backfat was the thinnest, and the backfat of B was the thickest, F1 and YOK were closer. F1 had the thickest skin, significantly greater than YOK and HZP. The result showed that F1 pigs had backfat thickness. The hind proportion of F1 was the highest, reached 33.0%, which is hybrids of mountainous and wild boar living in the bush, developed hindquarters related, but needs further study to determine. Lean meant rate of YOK was the highest, but BAM was the minimum. Fat ratio and lean meat ratio had opposite trends. In addition to lean meat rate, skin rate, bone rate and fat rate, the another traits did not statistically significant compared with another breeds of pigs, because its size was too small, suggesting that these traits were inappropriate to compare.

Meat quality of different breeds of pig

Pork color is one of the most important sensory qualities of the consumer. The observation of the pork color can initially determine the merits and freshness of the meat. It mainly affected by the color of pork muscle myoglobin content. The more myoglobin content has, the deeper pork color is. But the flesh is a key determinant of the chemical properties of myoglobin [7]. According to the research, Chinese local pig meat score is generally between 2.5 and 4.5 [8]. In this experiment, each set of data was within this range, the color is good. HZP had the highest meats core, while YOK was the minimum. Besides, pH is an important factor affecting meat quality, which is also an important indicator of reflection of post-mortem glycolysis rate of muscle glycogen in pig body [9]. Usually, pH value measured after slaughtering within 45 min is not less than 5.8, otherwise PSE meat; pH value within 24 h

Determination items	Breeds			
	F1	BAM	YOK	HZP
Myristic acid (C14:0) %	3.26 ± 0.12	5.85 ± 0.25	5.01 ± 0.22	2.23 ± 0.03
Palmitic acid (C16:0) %	26.61 ± 2.36	30.82 ± 3.02	33.00 ± 3.21	25.50 ± 2.11
Palmitoleic acid (C16:1) %	3.26 ± 0.14	5.80 ± 0.32	6.01 ± 0.25	2.01 ± 0.03
Stearic acid (C18:0) %	11.28 ± 0.65	9.13 ± 0.58	7.41 ± 0.74	11.79 ± 0.25
Oleic acid* (C18:1) %	38.15 ± 2.65	35.86 ± 2.51	37.02 ± 2.01	39.84 ± 1.02
Linoleic acid* (18:2) %	5.22 ± 0.16	7.31 ± 0.13	4.30 ± 0.14	7.61 ± 0.15
Linolenic acid * (18:3) %	6.05 ± 0.21	4.61 ± 0.31	3.97 ± 0.51	6.54 ± 0.25
Another %	6.17 ± 0.25	0.62 ± 0.36	3.28 ± 0.25	4.48 ± 0.25
SFA %	44.41 ± 3.14	49.44 ± 3.45	51.43 ± 3.85	41.53 ± 3.61
UFA %	49.42 ± 3.25	48.05 ± 3.05	45.29 ± 3.01	53.99 ± 3.24
UFA / SFA	1.11 ± 0.01	0.89 ± 0.01	0.88 ± 0.02	1.30 ± 0.03

Note: * means EFA.

Table 8: FA composition of different breeds in pig muscle %.

was not greater than 6.0, otherwise DFD meat. Generally considered, pH value of normal pork is from 6.1 to 6.4 [10]. Only pH of F1 pigs was less than 5.8, which may be related with its wild nature, concerning with ante-mortem weighing, expulsion and another stimuli. Therefore, the slaughter process should take early domestication, well-organized slaughter process or the use of electric shock and another slaughter measures to minimize the impact of stress factors on meat quality. The marbling score of HZP, BAM and F1 were higher than YOK outside, but the evaluation method of meat color is with a strong subjectivity, needing to be further improved. Water loss rate is an indirect indicator reflecting the water holding ability. The higher the water loss rate is, the poorer the water holding ability is. Storage losses are closely related to the water holding ability [11]. Storage losses of Y was significantly higher than F1 pigs and BAM ($P<0.05$), and significantly higher than the HZP ($P<0.01$). Research results suggest that local pigs have the ability in holding water, especially HZP show good meat characteristics. Muscle fiber diameter with tenderness and water holding ability are closely related. The finer the muscle fibers are, the greater the density is. The intramuscular fat (marbling) deposition amounts to more than the muscle fibers thick and low-density species [12]. The muscle fiber diameter of HZP was the smallest (37.04 μm), and various another breeds of pigs were higher than 40.0 μm, of which F1 pigs was the highest, up to 48.55 μm. The above results showed meat of HZP with better water holding ability and tenderness.

Muscle AA composition of different breeds of pigs

AA content and composition of pork evaluate the nutritional value of pork is an important indicator, is also an important factor in pork quality [13]. Glycine, Isoleucine, Proline, Serine, Alanine and Glutamic acid and another six kinds of flavor precursor AA are formed meat flavor necessarily, have a direct relationship with the flavor of the meat, especially glutamate is the most important flavor substances, with special effects to form meat flavor and to Buffer salty and sour taste [14]. The AA of BAM and wild hybrid pigs showed that 18 kinds of AA had significant differences among breeds, which muscle Glutamate and another flavor of BAM was highest, so its fragrant meat [15]. In this experiment, AA content of four breeds measured, total AA of F1 pigs was the highest and the main flavor was also the highest, reaching 27.85 g, accounting for 35.88% in the total of AA content.

Muscle FA composition of different breeds of pigs

Muscle FA include SFA and UFA, UFA is important meat flavor precursors, but essential nutrients [16]. Migdal et al. pointed out that meat high in PUFA, beneficial to human health [17]. Meanwhile, Wang Xinjie et al. found that a series of chemical substances produced by oxidative degradation of fatty acids is an important basis for the formation of chemical pork flavor through research on relationship between the muscle cell membrane FA content and succulent flavor; while the cell membrane as a place of various life activities occurred on regulating the production of a variety of flavors [18]. This experimental study showed HZP had the highest content of UFA, and UFA / SFA is 1.30. As can be seen pork quality of HZP was high, nutritional value was also high, with good flavors.

Comparison of volatile compounds in pork meats from all breeds

Based on fragrance types of some compounds described in previous reports, the following kinds of fragrance were identified: delicate fragrance (chloroform); apple blossom fragrance: (2-hexanone); vinegar fragrance (acetic acid); sulfur and fish fragrance (3,5-dimethylfuran); sweet caramel fragrance (methyl butyrate); and bitter fragrance (1-octen-3-ol). Flavor compounds contained in pork meat from all pig breeds were: 3-methyl-1-butanol (pungent fragrance);1-nonanal (delicate fragrance); octanal (delicate and fresh fragrance, tender fragrance); hexanal (delicate and grass fragrance, related to the smell of newly mown grass, also having the bad smell of green beans); 2-pentyl-furan (ham-like fragrance); 1-penten-3-one (onion fragrance and barbecue fragrance), (E,E)-2,4-decadienal (broth smell); and N-morpholinomethyl-isopropyl-sulfide (important source of meat taste). Compounds that have a relatively significant contribution for meat flavor are furans, aldehydes, and sulphur-containting compounds. Indeed, it has been demonstrated that furans are mainly produced from olefinic alcohols and play an important role in the formation of meat flavor.

Conclusion

- Daily gain and feed conversion of YOK was the highest, but HZP was far less than another groups. In growing and finishing pigs performance, HZP does not belong to the same grade compared to another breeds of pigs. The purpose of the study is conducive to the growth of co-depth knowledge of the pig.
- HZP was small breeds of pigs, their slaughter rate, carcass plagioclase were less than the rest of the group. The body of HZP is too small, the rest of the characters should not be up. F1 pigs had relatively thick-skinned, thin black fat thickness, and the highest proportion of hind legs. Lean meat rate of YOK was the highest, BAM was the minimum. Fat percentage and lean meat rate have contrary trends.
- PH, water loss rate, storage loss and muscle fiber diameter of HZP

was the lowest, while its meat color and marbling score was higher than YOK. As can be seen, HZP has the ability of good holding water and meat quality.

- In this experiment, 18 kinds of AA were determinated, the total amount of AA per 100 g (dry weight) of F1 pigs was the highest, and its main flavor was the highest, accounting for 35.88% of the total AA content, followed by HZP, accounting for 34.50% of the total AA content. Main AA in F1 and H were closer, which provided a certain AA flavor material basis for meat fragrant of HZP and F1.
- UFA content of HZP was the highest, reaching 53.99%, and its UFA / SFA was the maximum (1.30). As can be seen, HZP has succulent flavor and high nutritional value.
- The volatile compounds in pork belong to several classes and the highest relative amount of volatile compounds was found in BAM. The main volatile compounds in pork which may contribute to flavor of pork were 3-methyl-1-butanol, 1-nonanal, Octanal, Hexanal, 2-pentyl-furan, 1-penten-3-one, N-morpholinomethyl-isopropyl-sulfide, Methyl butyrate and (E,E)-2,4-decadienal.

To sum up: YOK was with good daily gain and high feed reward, while quality meat of HZP was better than another breeds.

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