COMPARISON OF CARCASSES AND MEAT QUALITY OF PUREBRED, F_1 AND THREE-WAY CROSSBRED PIGS

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Background

Conventional pig breeding programs mainly select low backfat thickness and high growth rate as performance traits because of their high economic value. However, several studies have shown that meat quality decreases when pigs are only selected for such performance traits (Sellier, 1988). Because higher meat quality and more uniform products are in demand by consumers and industry, meat quality traits are increasing in importance relative to performance traits (Sonesson, et. al., 1998). There are several indicator traits for meat quality, such as pH, water-holding capacity and color. The genetic correlation of performance traits with their estimated heritabilities must be known in order to combine meat quality with performance traits in a breeding program. Several studies have estimated heritabilities and correlation coefficients for these traits. Landrace pigs had a greater proportion of non-fat soft tissue, with a higher associated cost of maintenance than fat tissue, compared to Duroc pigs in the second half of an eight week restricted feeding period. At present, there is limited information about carcass composition and meat quality produced by different mating steps of pure breeding and crossbreeding.

Objective

The objective of this study was to examine and to compare the breeds and genders in carcass yields and meat quality of pure breeds (Yorkshire, Y; Landrace, L and Duroc, D), F1 (LY), Crossbred and three-way cross breed (LYD).

Materials and Methods

Animals: A total of 606 pigs in the live weight range of 90-120kg of Landrace (LL, n=81), Yorkshire (YY, n=123), Duroc (DD, n=100), F_1 (LY, n=62) and the cross breed of LYD (n=120) were slaughtered at the National Livestock Research Institute and their carcasses were chilled for 24 hours at 1°C.

Carcass evaluation: After slaughter, dressing percentage, carcass length, backfat thickness and loin eye areas were recorded for each carcass.

Meat quality evaluation: At 24 hours postmortem, each carcass was ribbed between the 10th and 11th ribs and the loin muscles were vacuum packed and stored at 5°C until determination of their chemical composition (AOAC, 1990), water holding capacity (Ryoichi et al., 1993), Warner-Braztler shear force, cooking loss and purge loss. To measure WBS (Warner-Bratzler Shear Force), loin muscles were cut into cubes (3cm thickness), heated to an internal temperature of 77°C in a water bath, cooled and measured. Cooking loss was determined by taking raw weight minus final cooked weight and dividing this by raw weight and then multiplying that figure by 100. The purge loss was measured by the amount of drip loss when meat was vacuum packed.

Statistical analysis: Data was analyzed using the SAS program (1990). The significant differences among means were separated by the Duncan test for breed and the method of least squares for gender.

Results and Discussion

Carcasses from Landrace and F_1 were significantly longer in length than the other breeds ($p<0.05$). Crossbred specimens produced by different mating steps in this experiment had low carcass productivity when compared to previous Crossbreds although the meat quality was improved with crossbreeding (data was not shown). Backfat thickness was higher for DD, F_1 and LYD than LL and YY ($p<0.05$). Yorkshire produced high loin area (44.49 cm^2) compared to the other breeds. The marbling scores of Duroc were highest (2.27) and followed by Crossbred, Landrace and F_1 when evaluated based on NPPC standards (data was not shown). The protein content was highest in meat from F_1 and followed by Crossbred. The protein content was lowest in meat from Duroc ($p<0.05$). The fat content of meat from Crossbred and Duroc was higher than from other breeds. The Crossbred meat had the highest WBS (Warner-Brazler Shear Force) as well as WHC (water holding capacity). The meat from F_1 had the highest cooking loss, whereas meat from Crossbred had the least cooking loss. The purge loss was highest for meat from LL, whereas meat from DD had the lowest purge loss among the breeds. In fat hardness, meat from DD was the most firm of the breeds. Barrrow was higher in WHC and lower in cooking loss when compared to the others; however, it had the highest purge loss. Boar had the least fat content in muscle and highest cooking loss among the genders. Meat from gilt had the lowest WBS and cooking loss. There was no significant difference in pH_{24h}.

Conclusions

Although LL and YY produced higher dressing percentages, loin eye area and carcass length, meat from DD had lower WBS, cooking loss, purge loss and higher WHC and fat hardness among the pure breed. LYD appeared to be slightly superior to the others when meat quality was evaluated and this was due to low WBS, cooking loss, purge loss and high WHC. The introduction of pure breed and establishment of mating steps is necessary to produce pork with highly acceptable meat quality as well as carcass yields. The results of this study provide beneficial information for the efficient selection of pure breeds and systematic cross-mating methods.

Table 1. Comparison of carcass characteristics of loin muscles from different breeds.

Traits	Breeds					Pooled SE
	LL	YY	DD	F_1(LY)	LYD	
Fasting weight (kg)	100.2	100.4	100.2	100.9	101.5	0.47
Dressing percentage (%)	73.3^{b*}	74.4^{a}	72.8^{b}	73.7^{ab}	74.4^{a}	0.32
Backfat thickness (cm)	1.8^{c}	1.9^{c}	2.3^{b}	2.0^{c}	2.6^{a}	0.08
Loin eye area (cm^2)	40.1^{b}	44.5^{a}	37.4^{b}	39.8^{b}	39.6^{b}	1.02
Carcass length (cm)	81.4^{a}	79.3^{b}	76.3^{c}	81.8^{a}	76.7^{c}	0.58

*Means within a same row having different superscript are significantly different($p<0.05$).

Table 2. Comparison of chemical composition and physical characteristics for loin muscles produced from different breeds.

Traits	Breeds					Pooled SE
	LL	YY	DD	F_1(LY)	LYD	
Protein (%)	22.6^{b}	22.6^{b}	21.8^{c}	22.9^{a}	22.4^{b}	0.09
Fat (%)	1.7^{b}	1.1^{c}	2.8^{a}	1.1^{c}	2.8^{a}	0.12
WBS ($0.5inch^2$/kg)	4.2^{ab}	3.9^{abc}	3.7^{bc}	4.0^{abc}	3.5^{c}	0.13
WHC (%)	53.6^{c}	52.6^{c}	58.3^{b}	52.9^{c}	61.7^{a}	0.38
Cooking loss (%)	37.1^{ab}	36.9^{b}	36.9^{b}	38.1^{a}	35.0^{c}	0.41
Purge loss (%)	4.3^{a}	3.2^{b}	1.4^{d}	2.9^{b}	2.1^{c}	0.25
Fat hardness	14.9^{bc}	13.0^{d}	17.5^{a}	15.7^{b}	15.9^{b}	0.49
pH_{24h}	5.5^{b}	5.6^{a}	5.5^{b}	5.6^{a}	5.6^{a}	0.01

Table 3. Least square means for physicochemical properties of genders

Traits	Gender			Pooled SE
	Gilt	Bore	Barrow	
Protein (%)	22.7	22.3	22.6	0.14
Fat (%)	1.8^{b}	1.3^{c}	2.3^{a}	0.19
WBS ($0.5inch^2$/kg)	3.8^{b}	4.0^{ab}	4.4^{a}	0.37
WHC (%)	4.7^{b}	5.1^{ab}	5.4^{a}	0.67
Cooking loss (%)	36.2^{b}	38.3^{a}	36.5^{b}	0.65
Purge loss (%)	2.7^{b}	2.6^{b}	4.0^{a}	0.43
Fat hardness	14.5^{b}	17.7^{a}	13.6^{c}	0.83
pH_{24h}	5.5	5.6	5.7	0.07

References

1. AOAC. 1990. Official Method of Analysis. 15th ed., Association of Official Analytical Chemists, Washington D.C.
2. Ryoichi, S., T. Degychi and Y. Nagata. 1993. Effectiveness of the filter paper press method for determining the water holding capacity of meat. Fleischwirtsch, 73:1399.
3. Sonesson, A. K., de Greef, K. H. and Meuwissen, T. H. E. 1998. Genetic parameters and trends of meat quality, carcass composition and performance traits in two selected lines of large white pigs. Livestock Production. 57: 23-32.
4. Sellier, P. 1988. Aspects genetiques des qualities technologiques of organoleptiques de la viande chez le proc. Journes. Rech. Proc. En France 20: 227-242.
5. SAS. 1990. SAS User's Guide, Statistics. SAS Institute Inc. Cary, NC.