THE QUALITY OF PORK FROM VARIOUS PIG GENETIC LINES

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Abstract

The purpose of the study was to analyze some pork quality factors with regard to various pig genetic lines. The study was conducted in spring on the material collected from fatteners born from sows of Polish Landrace (P.L.) breed matted with a cross-breed boar (pietrain (pi) x duroc (du)) and synthetic Hypor sows with PIC 337 boars. Two types of muscles were analyzed: *m. longissimus lumborum* and *m. semimembranosus*. The measurements included: dry matter, total protein, fat and collagen content as well as physicochemical properties, such as: colour, acidity and drip loss. Besides, the effects of heat treatment on the sensory value of the raw material, meat colour, exudate and tenderness were studied.

The results of the study show that percent of meat in carcass of pigs under investigation amounted to 57%. As has been found, total protein content of the porcine muscles depended on the breed. Pork from the synthetic cross-breeds was higher in protein than that from P.L. x (pi x du) cross-breeds. Fat content of the muscles from the pigs of the synthetic line was lower than that from three-breed crosses pigs. *M. semimembranosus* from three-breed pigs were higher in collagen as compared to those obtained from the hybrids of Hypor x 337. The analysis of meat after heat treatment did not show any significant qualitative differences depending on the genetic lines of pigs. The sensory analysis showed a correlation between the sensory value and the genetic line only for *m. l. lumborum.*

Key words: quality, pork meat, cross-breed

Introduction

Today, when the supplies of meat and meat products on food markets are in abundance, the quality of the product is of great concern of the consumers. Currently, the competition in Polish meat industry is so high that manufacturers of slaughter animals have to be subjected to the requirements of consumers. Creation and improvement of quality traits of pork starts with animal breeding and ends with the culinary preparation of meat by consumer. The specific quality traits of pork depend on age, genetic lines, raising conditions and feeding.

The choice of animal for crossing is a very important factor which affects the quality of carcass (Florkowski *et al.*, 2006). Breeding should be aimed at creating optimal interracial crossing variants, which would enable us to obtain maximum profits from both increased quantity and improvement of meat quality. Polish pork has a good quality, but insufficient carcass meatiness. Crossing Polish breeds with high-yielding breeds can improve the quality of raw meat (Rybarczyk *et al.*, 2002, Wojciechowski *et al.*, 2000).

The purpose of the study was to analyze some pork quality factors with regard to various pig genetic lines.

Material and methods

The study was conducted on material collected from fatteners born from sows of Polish Landrace (P.L.) breed matted with a cross-breed boar (pietrain x duroc) and synthetic Hypor sows with PIC 337 boars. The meatiness of carcass under investigation amounted to 57%. The experimental material consisted of two types of muscles: *musculus semimembranous* (*m. s.*) and *musculus longissimus lumborum* (*m. l. l.*).

In samples of meat, the content of the following chemical components was analyzed: dry matter according to Polish standards of PN-ISO 662:2000; protein content by Kjeldahl's method, using Kieltec™ 2300; free fat [PN-ISO 1444:2000]; connective tissue by determining hydroxyproline content [PN-ISO 3496:2000]. The estimation of the physicochemical properties of muscles included a measurement of colour indices: L*, a* and b* using a Minolta Chromameter CR 200, acidity according to PN-ISO 2917:2001, drip loss following the method of Honikiel (1998). In the samples of muscles after heat treatment (0.8% solution of NaCl, 1:2 proportion meat to solution, time of heat treatment: about 30 minutes until final temperature in the sample centre reached will

obtain 74 °C), colour values, exudates as cooking loss, tenderness as texture measurement were analyzed using the Zwick/Roell type Z010 machine (meat samples were shaped as cuboids and measured 10x10x10 mm, with fibres running perpendicular to the cutting plane. Sensory evaluation after heat treatment was carried out by 6 panelists according to 5-point Tilgner's scale of acceptance (Baryłko-Piekielna, 1975). The overall acceptability, colour, flavor, taste and tenderness were selected as the sensory descriptors.
The muscles of meat under investigation were collected from three fatteners from each of the four series in the spring time.
The data were analyzed statistically, using STATISTICA 6.0 software. One-way analysis of variance was used to test the effect of genetic lines on the variables examined. Significant differences between the mean values were determined using Duncan's test (α=0.05).

Results and Discussion

The result obtained in the study (Table 1) showed that the dry matter content of *m.s.*, as well as *m.l.l.* from both researched breeds was similar (about 26 %). A majority of authors confirmed that the dry matter content of *m.l.l.* was within the range from 25 to 30 %, although in *m.s.* it was from 25 to 32%. The dry matter content depends on animal species, age, breed, raising conditions and feeding (Buczma, 1999; Litwińczuk et al., 2002). The results of the study were consistent with those reported by Rybarczyk et al.(2002) in crosses with pietrain, duroc and Polish Landrace breeds.

Table 1

Chemical components

Parameter [%]	Type of muscles			
	m. longissimus lumborum		*m. semimembranous*	
	P.L. x (pi x du)	Hypor x PIC 337	P.L. x (pi x du)	Hypor x PIC 337
Dry matter	26.10[a]	25.56[a]	26.11[a]	26.25[a]
Protein	23.04[a]	23.45[b]	21.73[a]	22.10[b]
Fat	2.91[a]	2.95[a]	3.85[a]	3.42[b]
Collagen	0.10[a]	0.11[a]	0.17[a]	0.16[b]

a, b – different letters in the same row for the same parameter means differences statistically significant ($P \leq 0.05$)

The pig genetic line proved to be a factor significantly differentiating the protein content of meat. Pork from the synthetic cross-breed was higher in protein than that from P.L. x (pi x du) cross-breed.
The estimation of the content of intramuscular fat demonstrated that its lowest content was observed in *m.l.l.* of three-breed crosses pigs (2.91%) but the differences were insignificant. In case of *m.s.*, the fat content was significantly higher for three-breed crosses pigs than that observed for the synthetic line (3.84% and 3.42% , respectively). Intramuscular fat content affects the technological, nutritional and sensory value of meat and meat products. The results of numerous authors indicate that its optimum content for those values should be about 1.5–3% in *m.l.l.* and 2.2–4% in *m.s.* (Litwińczuk *et al.*, 2002; Wood *et al.*, 1996, Daszkiewicz *et al.* 2005).
The measurements of collagen showed that breed was not a factor differentiating the content of this protein in *m.l.l.*, but it did have a significant effect in case of *m.s.* – a significantly higher quantity was observed in meat of P.L. x (pi x du) cross-breed. Collagen is a major protein present in connective tissue. Added to meat products, it improves water binding capacity, juiciness and tenderness, reduces thermal exudates. The content of this protein depends on intravital factors and should be within 0.1–0.2% (Purslow, 2005; Sadowska, 1992; Vanderhaeghe & Deroanne, 1989).
Table 2 shows the differences in values of acidity. The lowest value of pH was observed in the *m.l.l* of P.L. x (pi x du) cross-breed. In the second type of muscles, the lowest values were

recorded for synthetic line, but the differences were insignificant. The meat from fatteners under investigation was characterized by good quality (Borzuta, Pośpiech, 1999), there was not recorded any pig presenting PSE, DFD, ASE meats.

Table 2

Physicochemical traits

Parameter		Type of muscles			
		m. longissimus lumborum		***m. semimembranous***	
		P.L. x (pi x du)	**Hypor x PIC 337**	**P.L. x (pi x du)**	**Hypor x PIC 337**
pH		5.70[a]	5.80[b]	5.76[a]	5.70[a]
Water holding capacity [%]		2.78[a]	2.69[a]	2.64[a]	2.44[a]
Colour	**L***	47.37[a]	51.73[a]	44.99[a]	50.59[a]
	a*	2.99[a]	2.66[a]	4.04[a]	4.74[a]
	b*	5.83[a]	4.99[a]	5.87[a]	5.67[a]

a, b – different letters in the same row for the same parameter means differences statistically significant ($P \leq 0.05$)

For the economy of meat processing, the value of water holding capacity is very important. Exudates of meat from both cross-breed were recorded on a similar level (P.L. x (pi x du): 2.78% *m.l.l.* and 2.63% *m.s.*; Hypor x PIC 337: 2.68% and 2.82%, respectively). The results of these analyses were in agreement with the earlier observation of Barton-Gade *et al.* (1993).
Table 2 also presents the results of colour traits analyses of raw meat. It was observed that the genotype had insignificant effect on CIE L*, a*, b* values.
Also, no significant differences in colour evaluation between the groups of fatteners were recorded in meat after heat treatment (Table 3).

Table 3

Analyses after heat treatment

Parameter		Type of muscles			
		m. longissimus lumborum		***m. semimembranous***	
		P.L. x (pi x du)	**Hypor x PIC 337**	**P.L. x (pi x du)**	**Hypor x PIC 337**
Drip loss [%]		25.57[a]	28.32[b]	28.55[a]	29.37[a]
Shearing force [N/cm^2]		58.90[a]	60.30[a]	51.26[a]	50.68[a]
Colour	**L***	13.11[a]	13.25[a]	13.02a	13.21[a]
	a*	25.57[a]	28.32[b]	28.52[a]	29.37[a]
	b*	58.90[a]	60.30[a]	50.68[a]	51.26[a]
Overall acceptability		3.64[a]	3.81[a]	3.82[a]	3.60[a]

a, b – different letters in the same row for the same parameter means differences statistically significant ($P \leq 0.05$)

Meat samples from *m.l.l.* of synthetic line had higher loss of water during heat treatment than the samples from other cross-breed. No significant differences were observed in the second type of muscles. The results of the experiment showed that the genetic line was not a factor differentiating tenderness of muscles, expressed by the shearing force.
In general, there were no differences in the overall acceptability of meat after heat treatment between groups of fatteners. Higher flavour and tenderness acceptance of *m.l.l.* and taste of *m.s.* were found in meat from three-breed crosses than from the synthetic line. However, the differences were insignificant.

Conclusions

1. Total protein content of the porcine muscles depended on the genetic line. Pork from Hypor x PIC 337 cross-breeds was higher in protein than that from P.L. x (pixdu). The analysis of collagen content showed significantly lower content of this protein in the muscles from synthetic line.
2. Intramuscular fat content of the muscles from the pigs of the synthetic line was lower than from three-breed crosses pigs.
3. The genetic line was not a factor differentiating the physicochemical properties in muscles under investigation.
4. The results of the study showed no differences in the overall acceptability of meat after heat treatment between groups of fatteners.

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