QUALITY OF PORK DEPENDING ON PIG GENOTYPES AND MEATINESS RANGE

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Background

Both quantity and quality of produced meat raw material depend, primarily, on the animals genotype [Blanchard 1995c, Blanchard 1995b] and as well as on environmental conditions, of which feeding and pre-slaughter stress and mutual interactions occurring between all these factors play a very important role [Blanchard 1994, Blanchard 1995a, Koćwin-Podsiadła et al., 1994; Fandrejewski 1995, 1999, Mc Keith and Ellis 1998, Urbańczyk 1998, Łyczyński et al., 2001a, 2001b, Różycki 1995]. Increased meatiness, accompanied by a simultaneous maintenance of high meat quality, is the most important objective of activities of all centres of animal breeding. However, reaching this goal is not an easy task, as confirmed by frequent reports [Grześkowiak et al., 1998, Pospiech et al., 1998] indicating that a relatively high percentage of animals is still characterised by defects found in meat after slaughter, mainly PSE and ASE (acid meat). It is well known that attempts to improve meatiness, without controlling factors promoting increased susceptibility to stress or development of acid meat, as a rule, result in deterioration in meat quality. Main parameters indicating high meat quality include: pH, LF, colour, tenderness and juiciness [Zessin et al., 1961, Kauffman 1996, Grześkowiak et al., 1998, Wood et al. 1998. Factors associated with animal handling can also exert a strong influence on the quality of meat raw material [Kauffman, 1996, Wajda 1998].

Objectives

The purpose of this study was to estimate swine meat quality depending on its genotype and three ranges of meatiness. In addition, the authors wanted to determine the level of occurrence of basic meat defects (PSE, ASE) in *musculus longissimus dorsi*.

Methods

Experimental material included 164 hogs of the following genotypes: 1 – [(Polish Landrace x Duroc) x Pietrain] [(♀PL x Duroc) x ♂Pi], n = 29; 2 – Polish Large White x Polish Landrace – (♀PLW x ♂PL), n = 40; [(Polish Large White x Polish Landrace) x Pietrain] [(♀PLW x PL) x ♂Pi], n = 27; 4 – synthetic line 990, n = 32; 5 – synthetic line 890, n = 36. Piglets with the initial bodyweight of 12 kg were housed in the piggery of Gorzyń Experimental Station, which belongs to the Department of Animal Feeding and Fodder Management of Poznań Agricultural University. The proper fattening was conducted from the bodyweight of 30 kg to about 105 kg using *ad libitum* feeding system. The entire period of fattening was divided into two sub-periods: period I (30 – 65kg bodyweight) – animals were fed complete diets containing in 1kg of feed: 13.5MJ ME, 18.0% crude protein and 1.04% lysine; period II (65 – 105kg bodyweight) – fatteners were fed complete diets containing, respectively, 12.8MJ, 16% and 0.88% of ME, crude protein and lysine. During the first period of experiment, only 2 animals were kept in experimental pens, while in the second – animals were kept in individual pens. When individual animals reached the final bodyweight of 105 kg, they were starved for 12 hours and transported to a slaughterhouse 40 km from the experimental farm. After 1-hour rest, animals were slaughtered using standard technologies applied in abattoirs. After slaughter meatiness was assessed on *musculus longissimus dorsi* (mld) directly after slaughter using, for this purpose, an ULTRAFOM 200 apparatus. In each experimental genotype, the following three meatiness groups were distinguished: up to 49.99%, from 50.00 to 54.99% and ≥55%. Within the above-mentioned groups, meat quality was estimated on the basis of: measurements of: $pH_{45'}$ and pH_{24h}, electrical conductivity ($EC_{45'}$ and EC_{24h}) and lightness of meat colour (L*) which was measured after 24 h cooling of carcasses. The above measurements were carried out on *musculus longissimus dorsi* below the last rib. Meat colour was estimated using a Minolta spectrophotometer. Meat acidity (pH_1 and pH_2) was estimated with the assistance of Handylab 2 apparatus (SCHOTT GERÄTE), while electrical conductivity (EC_1 and EC_2) was assessed in the same place 90' and 24 h after slaughter using an LF STAR apparatus (Matthäus). Carcass classification and limiting (critical) values allowing identification of normal meat (RFN), PSE and ASE meats were adopted after Borzuta and Pospiech (1999).

Results and discussion

Mean values of meatiness of investigated pigs in the genotype groups are shown on Fig. 1. Average carcass meat content of the first three pig genotypes ranged from 50.49 to 51.87%, of the fourth – 54.1% and of the fifth – 53.6%. Most of the experimental animals from the first three genotypes were characterised by carcass meatiness below 50%, those from the fourth genotype – above 55%, while meatiness of animals from the fifth genotype ranged from 50.00 to 54.99%. In the case of the last genetic group, the proportion of carcasses with meatiness above 55% was also high and reached 38.89%. Meat amount and quality of all investigated animals in relation to three ranges of meatiness is presented in Table 1. As a rule, extreme meatiness values of carcasses led to deterioration in meat quality traits. More detailed analysis of meat quality in three meatiness ranges of the experimental animal and in regard to their genotype is shown in Table 2. The most favourable values of meat quality parameters were found in carcasses of animals from (♀PLW x ♂PL) genotype. These results were confirmed by studies carried out by Koćwin-Podsiadła et al. [1994]. Depending on genotype, the proportion of carcasses with good meat quality ranged from 50.0% (line 890) to 85.0% (wpb x pbz) and on average was found to reach 68.90%. Of the two defects found in the examined meat, ASE meat was dominant – its mean level in the examined population of pigs amounted to 17.07%. Watery meat occurred less frequently – 14.03%. PSE meat was dominant in genotype one and four, while in the remaining genotypical groups, ASE meat was the most typical defect, even though none of the genotypes was obtained from crossing sows with Hampshire breed boars z. With regard to the first two ranges of carcass meatiness, i.e. up to 54.99% meat content, normal quality meat (RFN) was dominant in the examined carcasses and it amounted to: 74.55% and 73.44%, respectively. The same type of meat (RFN) was also dominant in carcasses characterised by the highest meatiness and its mean level in carcasses amounted to 55.56%. With respect to other types of meat occurring in the first two ranges of meatiness, watery meat was found in about 9 – 10% of meat, while acid meat – in approximately 16%. In the group of carcasses with meatiness over 55%, watery meat occurred somewhat more frequently (by about 4%). Among animal genotypes characterised with the highest meatiness (genotypes 4 and 5), PSE occurred more frequently in the meat of pigs from line 990, while ASE – in the case of animals from line 890. Results obtained in this study indicate that the increase of pig meatiness in Poland is still very often accompanied by increased level of meat defects. Their type is probably associated with animal genotypes.

Conclusions

1. Genotypes of the examined animals exert influence on carcass meat content.
2. With the increase of pig meatiness in the ranges of the five examined animal genotypes, their meat quality parameters tended to deteriorate, especially when their meatiness was above 55%.
3. The highest levels of normal meat (RFN) were found in the following genotypes: (♀PLW x ♂PL), [(♀PL x Du) x ♂Pi] and Line 990 (♀ x ♂).

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Table 1. Meat amount and quality traits of all investigated pigs depending on the meatiness range

Analysed traits	Meatiness range (%)*	Statistical value		
		$\bar{x}$	sd	v
Meatiness (%)	I	47.78^{BC}	1.73	3.61
	II	52.60^{AC}	1.36	2.59
	III	57.52^{AB}	1.80	3.14
pH_{45}	I	6.27	0.40	6.35
	II	6.32^{c}	0.47	7.42
	III	6.11^{b}	0.48	7.93
pH_{24h}	I	5.49^{BC}	0.15	2.67
	II	5.42^{A}	0.13	2.37
	III	5.40^{A}	0.11	2.09
$EC_{90'}$ (mS/cm)	I	4.85	2.80	57.85
	II	4.67	3.03	64.97
	III	5.91	4.82	81.70
EC_{24h} (mS/cm)	I	6.31	2.93	46.48
	II	6.31	2.96	46.91
	III	7.61	3.70	48.62
L*	I	56.39^{c}	4.44	7.87
	II	56.89^{c}	4.33	7.60
	III	58.85^{ab}	5.02	8.53

* - range of meatiness - I - <49,99%; II - <50 – 54,99%>; III - >55%;

$^{A-C}$ means marked with different superscripts denote statistically significant differences between compared groups at $P \leq 0,01$

$^{a-c}$ means marked with different superscripts denote statistically significant differences between compared groups at $P \leq 0,05$

Table 2. Meat quality depending on genotype

Genotype	No. of carcasses	Meat quality - % share of meat		
		RFN	PSE	ASE
[(♀PL x Du) x ♂Pi]	29	72.41	20.69	6.90
(♀PLW x ♂PL)	40	85.01	5.00	10.00
[(♀PLW x PL) x ♂Pi]	27	62.96	14.82	22.22
Line 990 (♀ x ♂)	32	71.88	18.75	9.38
Line 890 (♀ x ♂)	36	50.00	13.89	36.11
Total	164	68.90	14.03	17.07

Fig. 1. Carcass meatiness depending on genotype