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VARIABILITY OF PIG MUSCLES QUALITY OF TWO CROSSBREEDS AND TWO WEIGHTS

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INTRODUCTION

The muscle quality of pigs is very changeable because of a great intermuscular variability. Muscles differ from each other in the individual muscle fibres type content with different contents of myoglobin, oxidative and glycolytic enzymes (Monin and Ouali, 1991).

The meat of highly selected breeds of pigs has worse technological quality in comparison with pigs of primitive breeds. Lazar *et al.* (1991) cite the following expected frequencies of halothane reactors for three breeds of pigs: Swedish Landrace 0.91%, Large White 1.68%, Duroc 0.03% and German Landrace 12.75%.

Barton-Gade (1981) divides pig muscles to so called white, red and intermediate. The aim of genetic selection is to increase pig meat content, and this leads to the production of white muscles which mainly contain muscle fibres of type IIB (Ouali, 1991). White muscles are disposed to the development of PSE quality because of the fast post-mortal decrease of pH value (Monin and Ouali, 1991).
In the world, there is an evident trend to feed heavier pigs for dry ham production. The data about influence of pig weight (age) on the stress susceptibility and with this the predisposition to aberrant muscle qualities are in contradiction: Pospiech *et al.* (1989) cite that besides hereditary factors, the weight (age) of the animals also influences the muscle quality; as Kempster *et al.* (1984) attribute only inconsiderable influence the animal weight.

The aim of the research was to study intermuscular variability of pigs of different weights (ages) of two crossbreeds and their predisposition to the aberrant muscle quality occurrence in the production conditions in Slovenia.

MATERIALS AND METHODS

Pigs of two SDL (25% Swedish Landrace x 25% Duroc x 50% Large White) and SLG (25% Swedish Landrace x 25% Large White x 50% German Landrace) crossbreeds were fed up to two live weights: light group from 98 to 121kg (age six to seven months) and heavy group from 146 to 185kg (age eight to nine months). There were six animals in the heavy group of SDL crossbreed, and seven animals in each of other groups. Pre-slaughter and slaughter technology were standard for all groups of pigs.

Samples for histochemical analysis were taken 40 to 60 minutes post-mortem from *m.longissimus dorsi* - lumbar part (LD) and *m.serratus ventralis thoracis* (SV) of the left carcass halves. The content of oxidative (OF), glycolytic (GF) and intermediate (IF) muscle fibres was defined with succinic dehydrogenase activity (Nachlas *et al.*, 1957) and alpha-glycerophosphate dehydrogenase activity (Wattenberg and Leong, 1960) measuring methods. Muscles LD, SV, *triceps brachii* (TB), *quadriceps femoris* (QF), *semimembranosus* (SM) and *biceps femoris* (BF) were excised 24 hours post-mortem from left carcass halves. On the muscles, the following was analyzed:
pH-value (directly in muscles with pH-meter Testoterm 2300);

dielectric loss factor (d-value with Testron MS-tester);
colour (L-, a-, b- values with chronometer Minolta CR-200 b);
water holding capacity (WHC as a percentage of expressed fluid (% e.f.) with Wismer-Pedersen modification of Grau-Hamm method - Froehlich, 1977);
sensory properties (colour and wetness with the scale of 0-2.5-5 scores: 2.5 scores=colour and wetness of muscles of normal quality, 0 scores=pale or dry and sticky muscles, 5 scores=dark or wet muscles; marbling with the scale from 1-7 scores: 1 score=non-marbled muscles, 7 scores=markedly marbled muscles).

The total muscle pigment (TMP) content was also defined in LD and SV, with a Nit409 method (Trout, 1991).

RESULTS AND DISCUSSION

Red muscle SV and white muscle LD differ (P<0.001) from each other in total muscle pigment content and in the content of individual muscle fibres types, irrespective of weight and crossbreed (Table 1): SV muscle contains more TMP, OF and IF, while GF are predominating in LD.

In LD of two light animals of SLG crossbreed, degenerative changes of muscle fibres were established as a result of very fast anaerobic glycolysis. Higher content of OF and IF and absence of degenerative changes in muscles of SDL crossbreed animals point out the slightly higher aerobic potential and lower pre-disposition to the PSE quality development of pig muscles of this crossbreed.
LD of heavy animals of the SDL crossbreed contains more TMP (P<0.05) in comparison with light animals, which corresponds to the Warriss *et al.* (1990) statement that muscles of younger animals contain less pigment.

The muscles of both crossbreeds and both weights differ significantly (P<0.05 up to P<0.001) from each other in all physically evaluated properties (Table 2).

The d-values of all muscles are in the range of intact and intermediate cell structure, although the results of some analyses in LD of light animals of SLG crossbreed indicate the development of PSE quality. Fortin and Raymond (1988) also write about the unreliability of the d-value measuring method, while Chizzolini *et al.* (1993) quote the suitability of this method for detecting PSE quality meat.

The highest ultimate pH-values are for animals of both crossbreeds and weights measured in red QF muscle and the lowest in the white LD muscle. Increased ultimate pH-values (Barton-Gade, 1981) are pointed out in QF of heavy animals of both crossbreeds and TB, SV and QF of light animals of SLG crossbreed. Differences in pH-values between LD and SV muscles (P<0.05) confirm the hypotheses that the ultimate pH increases with the oxidative muscles capacity.

The highest L-values (the lightest colour) are for animals of both groups and crossbreeds measured in LD muscle and the lowest (the darkest colour) in the intermediate TB muscle.

Low a-values in LD (the less red colour) and high in SV (more red colour) match with the content of TMP in both muscles (lower a-values correspond to lower contents of TMP).

The lowest variability in b-values is shown in muscles of light pigs of SLG crossbreed (P<0.05), of which all analyzed muscles differ only from QF with the lowest b-value.

Muscles of heavy animals of both crossbreeds are essentially equal in sensory properties (Table 3), but muscles of light animals of both crossbreeds significantly differ (P<0.05 up to P<0.001) from each other in sensory properties (except in the wetness of the SLG crossbreed muscles).

Highly estimated (dark) colour of TB and SV muscles of light pigs from the SLG crossbreed, together with increased ultimate pH-value and proportionally high WHC in both muscles point out the appearance of DFD quality.

The most highly estimated wetness, low estimated (pale) colour and the most highly measured L -value in the LD muscle of light animals of SLG crossbreed point out the development of PSE quality, which is also verified by degenerative changes of muscle fibres established during the histochemical analysis.

Muscles of both animal groups of SDL crossbreed (except LD of heavy group) are slightly more marbled (higher scores) in comparison with SLG crossbreed, but the differences are not significant. The marbling of muscles of heavy animals from both crossbreeds was higher (differences are significant for LD and BF of animals of the SLG crossbreed) in comparison with light animals.

CONCLUSIONS

Pigs of both crossbreeds (SDL and SLG) display a great intermuscular variability in analyzed properties. Muscles of heavy pigs of both crossbreeds, in comparison with light pigs, are more equalized in sensory properties.

As regards the histochemical analysis, muscles of the SDL crossbreed animals in comparison with SLG crossbreed, have higher aerobic potential and a minor trend to the appearance of PSE quality.

Regarding performed analyses, intermediate muscle TB of pigs of both weights and crossbreeds, demonstrate the characteristics of the red muscle.

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Table 1. Variability of pigs muscles of SDL/SLG/crossbreeds in chemical and histochemcial properties (t-test$^{***, x, +}$).

Group	Muscle/ property	LD x	SV x	t-value
Heavy	TMP, mg/g	1.69 /1.67/	4.51 /4.60/	-8.49*** /-8.00***/
	OF, %	12.50 /11.89/	34.87 /33.76/	-18.76*** /-12.32***/
	IF, %	16.03 /14.59/	43.12 /35.74/^{x}	-11.87*** /-8.86***/
	GF, %	71.45 /73.53/	22.00 /30.49	23.63*** /13.67***/
Light	TMP, mg/g	1.35 /1.46/	4.18 /3.99/	-9.2*** /-12.26***/
	OF, %	12.25 /9.81/	33.96 /28.46^{x+}/	-10.96*** /-8.94***/
	IF, %	18.90 /16.37/	38.56 /34.64/	-9.78*** /-7.68***/
	GF, %	68.80 /73.81/	27.47 /36.89^{x}/	14.89*** /9.47***/

*** $P \leq 0.001$ differences between muscles.

^{x} $P \leq 0.05$ differences between crossbreeds.

$^{+}$ $P \leq 0.05$ differences between heavy and light group.