MEAT QUALITY OF SLOVENE LOCAL PIG BREED KRŠKOPOLJE

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Background

On of the reasons for the growing interest in local pig breeds is better quality of their meat compared to modern breeds (Dunn, 1996; Labroue et al., 2000). In Slovenia, the black-belted pig Krškopolje is the only local breed of pigs. Due to a very small herd size it is endangered of extinction. The interest for this breed was revived in the past ten years. The breed is adapted to poor breeding conditions and is reputed for good meat quality (Šalehar, 1994). However this reputation of good meat quality has so far not been objectively verified. The aim of this study was the first evaluation of meat quality of Slovene local pig breed Krškopolje in comparison to usual market pigs and Krškopolje crosses under the similar rearing conditions.

Material and methods

The experiment was conducted on 41 pigs (24 females, 17 castrated males) of three genotypes, pure Krškopolje (KK), the offspring of KK female crossed with meat-type landrace male (LN55×KK) and L55×(LN11×LW) pigs, issue of crossing large white (LW)×landrace (LN11) females with meat-type landrace male (LN55). Pigs were housed in four series from November to January. During the fattening they received two diets; from 25 to 60 kg they were fed the diet containing 12.7 MJ of metabolizing energy, 16 % crude protein (8.8g/kg lysine), from 60 kg onwards pigs received the diet containing 11.7 MJ of metabolizing energy, 19.5 % crude protein (12g/kg lysine) with addition of ensiled maize grain. Pigs were fattened by a local farmer, group-housed, fed twice daily and had voluntary access to food. All pigs were slaughtered on the same day, according to routine procedure (fasting, 2 hours resting, electrically stunned, 1.5 A, 200 V). After slaughter, carcass weight and lean meat content (%) were recorded by authorized service. One hour post mortem pH (pH_1) was measured directly in the *longissimus dorsi* (LD) muscle at the level of the last rib, and the samples of LD muscle taken only from KK pigs for histochemical analysis. The following day ultimate pH, meat color (1-6 according to Nakai et al., 1975), L value (Minolta Chromameter CR300) and water holding capacity evaluated as imbibing time (time necessary for 1 cm^2 of filter paper Schleicher-Schell 589[1] to become wet) were assessed on LD muscle at the level of the last rib. Samples of LD muscle were taken for DNA test (Fujii et al., 1991), chemical and sensory analysis. Lipids were extracted from 10 g samples according to Folch et al. (1957) and results expressed as mg/g of fresh weight. Samples for sensory evaluation were thawed overnight at 4°C and roasted in the oven to internal temperature of 71.6 ± 1.2 °C (mean ± s.d.). Six panelists judged aroma, juiciness, tenderness and fineness on a 1 to 7 point scale (increasing intensity of perception). Data were analyzed by GLM procedure of SAS (1990), with genotype and sex and their interaction as effects. Least square means (lsmeans) for genotypes were compared at the 5% probability level.

Results and discussion

At the start of the experiment we had no knowledge of stress susceptibility gene (ryr1) status in the herd of KK breed. When low pH_1 values were observed in pure Krškopolje pigs, we decided to perform DNA tests. We found a high incidence of ryr1 gene mutation (88 % ryr1-Nn or ryr1-nn) in pure KK pigs (Table 1). On the other hand only two carriers (ryr1-Nn) were found in LN55×KK pigs, where both males used were mutation free (ryr1-NN). The histochemical composition of LD muscle (8.7% of slow-twitch, oxidative, 18.6% of fast-twitch, oxidative and 72.7 % of fast-twitch, glycolitic fibres) of pure KK pigs showed no particularities and was similar to the histochemical composition reported for modern pig breeds in Slovenia (Fazarinc et al., 1995). However differences between animals within the KK breed were large; significantly more slow-twitch, oxidative fibres were found in stress resistant pigs (ryr1 nn) (Fazarinc et al., 2002). At slaughter, both pure KK and LN55×KK pigs were heavier and older compared to usual market crosses, namely all pigs were slaughtered on the same day, but they were housed in four series within two months, usual market pigs being included the last. In the present experiment all pigs were rather fat due to the unlimited access to food. As expected, usual market pigs were the leanest and KK pigs were the least lean with LN55×KK pigs in the middle. Considering that the usual market pigs were lighter, part of the difference comes presumably from the lower weight. However, similar conclusion can be drawn after the correction for carcass weight (regression on carcass weight in the model; data not shown). According to the literature (Legault et al., 1996; Santos e Silva et al., 2000; Labroue et al., 2000) local pig breeds present less lean and conformed carcasses. However the differences reported are more important than the differences obtained in our study. Moreover, no significant difference of carcass lean was seen, when comparing pure KK and LN55×KK pigs. This can probably be attributed to ryr1 genotype of KK males (one was ryr1-Nn, the other ryr1-nn whereas both males used for LN55×KK pigs were ryr1-NN); since ryr1 gene mutation is known to increase muscularity (Guéblez et al., 1995; Larzul et al., 1997). Pure KK pigs had lower pH_1 than LN55×KK pigs or usual market pigs due to their higher stress susceptibility. The later can also be responsible for higher pH_{24} in pure KK pigs, resulting probably from increased glycogen consumption prior to slaughter. More intramuscular fat in KK pigs, according to the literature, is not related to ryr1 genotype, but is more likely in relation to overall carcass fatness. Lower resistance to cutting, finer texture observed in KK pigs and more tender meat in LN55×KK pigs indicate advantage of KK breed for eating quality. Higher intramuscular fat content can be an explanatory factor for better texture properties in pure KK pigs, but can not explain more tender meat observed in LN55×KK pigs. More intramuscular fat and more tender meat of local pig breeds have also been reported by Labroue et al. (2000). We can suspect that due to the low pH_1 some meat quality traits were deteriorated in pure KK pigs (i.e. water holding capacity, texture).

Conclusions

The observed stress susceptibility of local pig breed Krškopolje represents additional problem for the future professional work on this breed. Despite stress susceptibility and consequently increased glycolysis intensity, the Krškopolje breed presented some advantages regarding meat eating quality.

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Table 1: Occurrence of mutated ryr1 gene (n allele) in three pig genotypes

	NN	Nn	nn	No. of pigs
KK	2	12	3	17
LN55 × KK	10	2	0	12
LN55 × (LW×LN11)	8	4	0	12
No. of pigs	20	19	3	41

KK=Krškopoljec; LW= large white; LN11= landrace female line; LN55=landrace male line

Table 2: Carcass, muscle and meat quality traits (lsmeans± stderr) in three genotypes

	Genotype[a]			
	KK	L55 × KK	L55 × (LW×L11)	P
No. of pigs	17	12	12	
Age at slaughter, days	$244^b \pm 5$	$230^b \pm 5$	$210^c \pm 6$	0.000
Carcass weight, kg	$98.0^b \pm 2.8$	$95.4^b \pm 3.4$	$82.1^c \pm 3.3$	0.002
Carcass lean, %	$46.2^b \pm 0.6$	$48.1^{bc} \pm 0.8$	$50.3^c \pm 0.7$	0.001
Muscle properties				
pH at 1 hour postmortem	$5.82^b \pm 0.07$	$6.15^c \pm 0.09$	$6.17^c \pm 0.08$	0.004
pH at 1 day postmortem	$5.60^b \pm 0.03$	$5.50^c \pm 0.03$	$5.45^c \pm 0.03$	0.001
Color intensity (1-6)	3.7 ± 0.1	3.8 ± 0.1	3.7 ± 0.1	0.939
Minolta L	54.2 ± 1.0	54.1 ± 1.3	55.0 ± 1.2	0.854
Imbibing time, sek	37 ± 9	12 ± 11	24 ± 11	0.211
Intramuscular fat, %	$3.0^b \pm 0.2$	$2.1^c \pm 0.2$	$1.9^c \pm 0.2$	0.001
Marbling (1-7)	3.2 ± 0.2	2.8 ± 0.3	2.6 ± 0.3	0.156
Cooked meat properties				
Aroma (1-7)	5.2 ± 0.1	5.3 ± 0.1	5.1 ± 0.1	0.072
Juiciness (1-7)	4.9 ± 0.1	5.0 ± 0.1	4.8 ± 0.1	0.301
Tenderness (1-7)	$5.4^{bc} \pm 0.1$	$5.7^c \pm 0.1$	$5.2^b \pm 0.1$	0.001
Fineness (1-7)	$5.2^b \pm 0.2$	$5.1^{bc} \pm 0.1$	$4.9^c \pm 0.1$	0.057
Cutting force by INSTRON				
Perpendicular (N)	$58.5^b \pm 2.0$	$57.8^b \pm 2.4$	$67.3^c \pm 2.4$	0.011
Parallel (N)	46.1 ± 1.4	44.1 ± 1.7	48.6 ± 1.7	0.175

The genotype×sex interaction was insignificant for the presented properties.
[a] KK=Krškopolje; LW=large white; L11=landrace female line; L55=landrace male line
[b, c] Means for the genotype bearing different superscripts differ at the P<0.05 level