THE INFLUENCE OF PRKAG3 GENE ON MEAT QUALITY OF STRESS RESISTANT FATTENERS

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Introduction

The presence of the RN gene effects pork meat quality. The meat from RN^- has 40 to 70% higher glycogen content, a low ultimate pH measured at 24 hours post slaughter (<5.5), paler meat, reduced technological yield and lower (about 1%) protein content. Initially, the phenotype of RN gene was estimated on the basis of Napole yield, then *in vivo* or *post mortem* measurements of muscle glycolytic potential (GP) (Fernandez *et al.*, 1990, Le Roy *et al.*, 1994, Lundstrom *et al.*, 1996). Milan *et al.*, (2000) found dominant RN^- mutation in PRKAG3 gene in codon 200 (Q200R) and shown that phenotypic effect of $Arg^{200} \rightarrow Gln$ reduces glycogen content in meat after slaughter. In addition, a new allele (V199I) in PRKAG3 gene affecting glycogen content, ultimate pH and colour, has been found (Milan *et al.*, 2000, Ciobanu *et al.*, 2001). The presence of Q200R mutation was found in pure or crossbred Hampshire pigs, while V199I polymorphism in breeds other than Hampshire (Milan *et al.*, 2000, Ciobanu *et al.*, 2001). The objective of this experiment was the assessment of the impact of the PRKAG3 gene on the meat quality of stress resistant fatteners.

Materials and Methods

The investigations covered 384 stress resistant fatteners [Landrace-79, Landrace x Duroc – 125, Landrace x Yorkshire – 67, (Landrace x Yorkshire)x Duroc – 83, (Landrace x Yorkshire)x(Duroc x Pietrain)-30]. The animals were kept under the same environmental conditions and fed a full bath feed. The animals were slaughtered 2-4 hours after transportation using electrical stunning method and recumbent bleeding out (Inarco system). The following meat quality characteristics were determined: pH of meat measured directly in *longissimus lumborum* (LL) muscle (45 minutes, 120 minutes and 24 hours after slaughter) using pH-Master apparatus produced by Draminski., electrical conductivity (EC) evaluated in 35 minutes, 120 minutes and 24 hours *post mortem* using LF-Star apparatus (Matthaus -Germany), R_1 indicator expressed as IMP/ATP ratio at 45 minutes *post mortem* according to Honikel and Fischer (1977) meat lightness (L*) measured Minolta CR-310 Chroma Meter in CIE L*a*b* system, water holding capacity (WHC) according to Grau and Hamm (1952) with Pohja and Niniivaara (1957) modification, technological yield in cured and cooked meat (24 hours after slaughter) according to Naveau *et al.*, (1985) with a modification of temperature in geometric centre of the probe (72°C), drip loss determined in 48, 96 and 144 hours *post mortem* according to Prange *et al.*, (1977) and shear force (in 48 and 144 hours after slaughter) using the Instron 1140 apparatus with Warner-Bratzler device. The analysis of protein, fat, water and dry matter content in LL muscle, was performed. The RYR1 genotypes were established according to Fujii *et al.*, (1991). At 45 minutes *post mortem*, samples from LL muscle were collected in tubes with 0,5M PCA for subsequent determination of the glycolytic potential (GP) according to formula proposed by Monin and Sellier (1985). The phenotype of RN gene was identified on the basis of glycolytic potential (GP) and its bimodal distribution: rn^+rn^+ (GP≤130μmol/g) $RN^-/?$ (GP>130μmol/g). The polymorphism of PRKAG3 gene was identified according to Milan *et al.*, (2000). The data was analysed using one-way analysis of variance in non-orthogonal scheme. The significance of differences between means was calculated using Duncan's test.

Results and Discussion

The analysis of variance showed the influence of PRKAG3 gene only on the following (from 15 measured in different time) meat quality parameters: glycolytic potential, lactate content, ultimate pH measured in 24 hours after slaughter and protein content (Table 1).

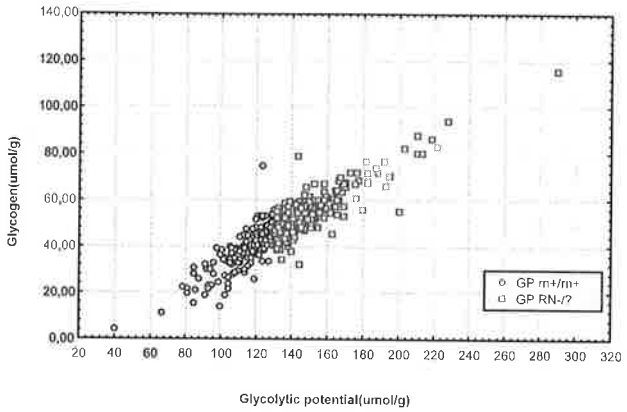
Meat from AA (RN^-/RN^-) animals compared with meat tissue from GG (rn^+/rn^+) fatteners had the lowest pH_{24} (lower about 0.1 pH units) and lactate content (Table 1). The pH_{24} range obtained in this experiment was lower then in the study of Le Roy *et al.*, (2000), where $pH_{24}LD$ between RN^-/RN^- and rn^+/rn^+ ranged 0.2 units (5.5 vs. 5.7 respectively). No statistically significant differences between AA and GG animals (RN^-/RN^- and rn^+/rn^+ respectively) for GP level, glycogen content and protein content (typical for RN^- phenotype) were identified in the present study (Table 1). The data presented in Figure 1 showed a high share (55%) of animals with high glycolytic potential (GP>130μmol/g with phenotype $RN^-/?$) and high glycogen content in group of fatteners identified by PCR-RFLP DNA test as GG (rn^+/rn^+) animals. In the investigations of Fontanesi *et al.*, (2003) it was shown, that high GP in some animals, was not explained by the presence of the 200Q allele, this may suggest other genetic factors could influence this parameter in different pig populations. Also, Meadus *et al.*, (2002) reported, that PRKAG3 mutation was not found in 27% of retailed pork chops samples that had high GP values.

Table 1: Means and their standard deviations for meat quality traits from different PRKAG3 genotypes.

Trait	PRKAG3				F-emp. p-value
	AA (RN^-/RN^-) n=6	AG (RN^-/rn^+) n=27	GG (rn^+/rn^+) n=351	Average n=384	
Glycolytic potential (µmol/g)	145,63b ±21,87	120,65a ±22,04	134,55ab ±26,95	133,75 ±26,79	4,034 0,02
Glycogen	56,83 ±9,61	43,32 ±11,74	47,77 ±13,59	47,61 ±13,49	2,814 0,061
Lactate	31,98a ±5,28	33,94ab ±11,12	39,28b ±11,00	38,79 ±11,05	4,165 0,02
pH_{24}	5,50A ±0,11	5,54AB ±0,09	5,61B ±0,12	5,60 ±0,12	6,667 0,002
Protein (%)	22,32a ±0,52	22,68b ±0,55	22,38ab ±0,60	22,41 ±0,60	3,377 0,04

Means marked different letters a, b differ statistically at $p \leq 0.05$

Fig.1 Glycolytic potential and glycogen content in group of animals identify as GG(rn+/rn+) by PRKAG3 PCR-RFLP DNA test



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