THE EFFECT OF INTERACTION BETWEEN PKM2 AND CAST/HinfI GENOTYPES FOR PORK MEAT QUALITY[#]

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Introduction

The rate and extend of changes in muscle tissue after slaughter determinate the quality and technological usefulness of meat. Pyruvate kinase catalyzes the reversible conversion of phosphoenol pyruvate to pyruvate. It occurs in four isozymic forms M1, M2, L, and R, which express tissue specifically (Immamura *et al*., 1986). M2 form is placed in the muscle, heart, and brain; and by L and R in hepatocytes and erythrocytes, respectively (Takegawa *et al*.,1984). The M1 and M2 isozymes are produced from a single PK-M gene, located in 7(q12-q23) pig chromosome (Noguchi *et al*., 1986, Fontanesi *et al*., 2003). Post mortem proteolysis is also associated with the activity of the calpain system, comprising m- and m-calpain, and their specific inhibitor protein, calpastatin (Sensky *et. al*., 1999). There is evidence indicating that in different species, calpastatin activity postmortem is highly related to meat tenderness (Parr *et al*., 1999).

The aim of this study was to analyse the effect of interaction between PKM2 and CAST/HinfI genotypes for meat quality traits of stress resistant fatteners.

Materials and Methods

The studies covered 243 pigs, of which 95 were of the Landrace breed, 66 Landrace x Yorkshire and 82 (Landrace x Yorkshire) x Duroc crossbreeds. All animals were free from gene $RYR1^T$. The animals were slaughtered using electric stunner (INARCO line, STORK) and bleeding lying down 2-4 h after transportation, during autumn and winter season. The quality of meat was evaluated after slaughter on the *musculus Longissimus lumborum* (*LL*) (after last rib), on the basis of the following parameters: pH of the muscle tissue measured directly in the LL muscle 35 min, 2h, 3h, 24h, 48h, 96h and 144h and in water homogenate at 45 min *post mortem*, electric conductivity (EC) measured with LF-Star conductometer (Matthaüs) 35 min, 2h, 3h and 24 h *post mortem*, colour lightness (L*, Minolta CR310), rate of ATP breakdown expressed by R_1 = IMP/ATP indicator at 45 min *post mortem* (Honikel & Fischer 1977), water holding capacity (WHC) (Grau-Hamm 1952 as modified by Pohja & Ninivaara 1957), drip loss at 48h, 96h and 144h (Prange *et al*. 1977), technological yield in the curing and thermal processing (TY). The samples cut from the *LL muscle* at 45 min *post mortem* were analysed for the glycolytic potential (GP) and content of glycogen and lactate using enzymatic methods. The GP was calculated according to Monin & Sellier (1985). The chemical composition of muscle tissue was also analysed. Genotypes of PKM2 gene were identified by the PCR/SSCP method according to Fontanesi *et al*. (2003) and genotypes of CAST/HinfI gene by PCR/RFLP method according to Ernst *et al* (1998) . The data were statistically analysed using two-way anova (PKM2, CAST/HinfI).

Results and Discussion

Animals being TT homozygotes of PKM2 gene had statistically significant (P£0,05) higher GP and lactate level than CC homozygotes. It was confirmed by the lowest pH value at 3 h (P£0,05), 24 and 144 h (P£0,05) post mortem, faster rate of ATP breakdown (P£0,01) and greatest drip loss at 96 (P£0,01) and 144 h (P£0,05) after slaughter (2,09 and 1,39% respectively) in group of TT animals.

Table 1. The influence of CAST/HinfI genotypes on meat quality traits

Trait	CAST/HinfI genotype		
	AA	AB	BB
pH_{45}	6,51b±0,14	6,45ab±0,25	6,36a±0,31
pH_{24}	5,64b±0,09	5,63a±0,14	5,56a±0,11
EC_2 (mS/cm)	2,78a±0,81	2,83ab±0,73	3,11b±0,81
R_1	0,88a±0,05	0,88a±0,05	0,89b±0,03
Drip $loss_{96}$ (%)	9,07A±3,40	9,47AB±2,60	10,58B±3,11

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In the table mean values and standard deviations are given. a, b – means signed by different small letters differ at P≤0,05; A, B – means signed by different letters differ at P≤0,01

Analysing the influence of CAST/HinfI gene polymorphism on meat quality we can stste that BB homozygous animals by the lowest pH at 45 min and 24 h after slaughter, highest R_1 value (P£0,05)and significant highest drip loss at 96 h (P£0,01) were characterised (Table 1).

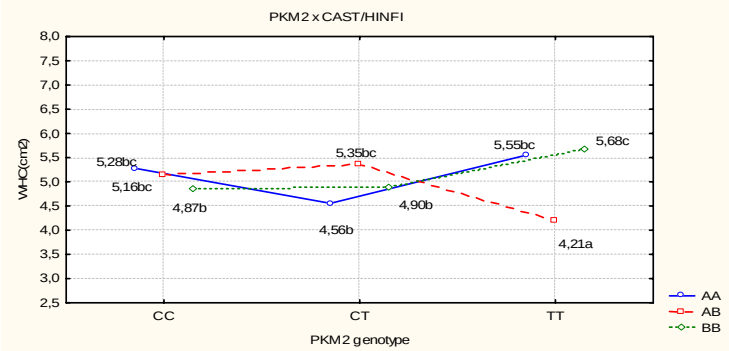

Fig. 1 Interaction between PKM2 genotype and CAST/HinfI genotype for WHC

The interaction between PKM2 and CAST/HinfI genotypes was statistically significant (P£0,05) for pH_{144}, EC_2 and WHC. Animals of AA genotype at CAST/HinfI locus were differentiated by PKM2 genotypes. in domain of pH_{144} and EC_2. AA homozygotes at CAST/HinfI locus with TT genotype at PKM2 locus in comparison to AA/CC animals (CAST/PKM2 genotypes respectively) had higher (0,22) pH_{144} value and lower (0,9 mS) EC_2. With regard to WHC animals with AB and BB CAST/HinfI genotypes were differentiated by PKM2 genotype (Fig 1).

Conclusions

The obtained results suggest that disadvantageous effect of TT genotype of PKM2 gene for meat quality traits may be suppress if fatteners are simultaneously AA homozygotes at CAST/HinfI locus.
Statistically significant differences of WHC between averages of PKM2 genotypes only with AB CAST/HinfI genotype are associated.

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