THE COMPARISON BETWEEN NN AND Nn PIGS FOR MEAT QUALITY AND GLYCOLYTIC POTENTIAL MEASURED BEFORE AND AFTER SLAUGHTER

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Background. It is known that PSE meat characterized by a fast *post mortem* pH fall is mainly iduced by the major halothane sensitivity or stress susceptibility gene (HAL^n gene). In many studies it has been showed that the heterozygous pigs (Nn) are more or less intermediate between both homozygous (NN and nn) for meat and carcass quality criteria. In this way, the heterozygous pigs (Nn) are proposed for pig production in many countries because they have superior carcass quality as compared to NN pigs and better meat quality than nn pigs. In some studies it has been found that a stressful preslaughter treatment increased the percentage of PSE carcasses in Nn pigs but this is not completely clear at the present day. It is interesting to search why some heterozygous pigs give PSE meat while the others do not.

Objectives. The aim of this work was to compare NN and Nn pigs for glycolytic compounds of Longissimus dorsi (LD) muscle one day before and 45 min after slaughter and meat quality criteria.

Methods. The investigations were carried out on 20 homozygous and 20 heterozygous (10 castrated males and 10 gilts in each group) pigs derived from crossbreeding of Polish Landrace with P76 boars (a French composite line). Blood samples were collected into 10 ml sterilised polyethylene tubes with dipotassium-EDTA as anticoagulant. DNA was isolated according to Kawasaki (1990) and Coppieters et al. (1992) and the RYR1 (HAL) genotypes were identified by PCR/RFLP method as described by Kurył and Korwin-Kossakowska (1993). The animals were slaughtered at about 100 kg live weight, in a slaughterhouse 60 km far from the pig farm, by electrical stunning (180-220 V; 0.5-0.8 A; 8 s) after 2-4 hours lairage time.

The day before slaughter biopsy samples were taken from the *Longissimus lumborum* using a "spring biopsy" (Biotech, Slovakia) according to procedure described by Talmant et al. (1989). At 45 min after slaughter samples were taken again from the same region of muscle. In both samples, glycogen, glucose and glucose-6-phosphate were determined following the procedure of Dalrymple and Hamm (1973) and lactate according to Bergmeyer (1974). Glycolytic potential (GP) was calculated according to the formula proposed by Monin and Sellier (1985): GP=[lactate]+2([glycogen]+[glucose]+[G-6-P]).

Meat quality was evaluated on the *LD* muscle at the level of the last rib. pH_1 (in muscle homogenates) and R_1 value (IMP/ATP, according to Honikel and Fischer, 1977) were measured at 45 min after slaughter in the *LD* muscle. pH_{24} was measured on *LD, Semimembranosus(SM)* and *Biceps femoris(BF)* muscles. Meat lightness was determined using an apparatus Momcolor-D3098 with white standard, and WHC was evaluated according to Grau and Hamm (1952) as modified by Pohja and Ninivaara (1957), both in LD. RTN was evaluated according to Naveau et al. (1985). The muscles *SM* and *BF* were cured and smoked according to technology utilized in polish meat industry. Muscles were cured with brine according to Polish norm. After weighting the hams were dried by hot air, smoked, cooled and weighted again. The processing yield was calculated as weight of smoked meat/weight of raw meat. Data were analysed using t-test because the effect of sex was not siginificant.

Results and discussion. The results showed that Nn pigs had faster pH fall (lower pH_1), higher R value and higher PSE frequency (by around 15%) than NN animals (tab. 1). This agreed with many reports that the rate of post mortem biochemical changes and the meat condition depend on halothane sensitivity (for review, see Sellier and Monin, 1994; Koćwin-Podsiadła et al., 1995). For other meat quality traits such as ultimate pH, meat lightness, WHC and meat processing yield, Nn pigs did not differ significantly from NN pigs, in despite of a tendency towards lower meat quality (Table 1). Przybylski et al. (1994) found no significant effect of the HAL^n allele gene when comparing NN and Nn for Polish Landrace pigs for meat processing yield. The HAL genotype (Table 1) did not affect the glycolytic potential, but influenced the lactate content as evaluated in biopsy and post mortem samples. The present findings are in agreement with previous reports, which indicated that muscle glycogen and glycolytic potential are not markedly affected by halothane sensitivity as measured in biopsy samples (Klont, 1994; Koćwin-Podsiadła et al., 1995; Przybylski et al., 1996) or post mortem (Monin and Sellier, 1985; Sellier et al., 1988). The lack of difference between glycolytic potentials at both times indicated that glycogen consumption did not differ between genotypes during the slaughter process (transportation and lairage at the slaughterhouse), what is confirmed by results shown in Fig. 2. The significant differences observed between NN and Nn pigs for lactate before and 45 min after slaughter are probably due to the fact that the n allele accelerates the glycolysis in anoxic muscle in an additive way (Lahucky et. al., 1993; Klont, 1994; Koćwin-Podsiadła et al., 1995). Such differences in biopsy samples between HAL genotypes were reported by many researches. However, this effect did not exist when the samples were frozen *in situ* (Hall and Lucke 1983). Distributions of lactate measured in biopsy samples showed that 80% of Nn pigs had lactate levels above 10 µmol/g fresh muscle tissue, and five of these pigs produced PSE meat after slaughter (Fig. 1). A reverse situation is observed for NN pigs whose 80% were characterised by lactate below 10 µmol/g.

Conclusions. The present results confirmed that HAL genotype has no effect on muscle glycolytic potential evaluated *in vivo* as well as after slaughter. This indicates that glycogen consumption does not differ between genotypes during the slaughter process

(transportation and lairage at the slaughterhouse). There was no significant difference in meat quality between NN and Nn pigs although the latter showed a tendency to reduced meat quality.

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Table 1

The comparison of HAL NN and Nn genotypes for biopsy parameters and meat quality traits

Traits	HAL genotype	
	HAL^NHAL^N	HAL^NHAL^n
Number of animals	20	20
Biopsy samples		
Glycolytic potential (µmol/g)	182.82±52.40	178.31±43.7
Lactate (µmol/g)	**a** 8.90±3.91	**b** 13.64±4.23
Post mortem		
Glycolytic potential $(\mu mol/g)_{45\ min.}$	139.95±29.02	142.85±23.74
Lactate $(\mu mol/g)_{45\ min.}$	**a** 54.50±19.71	**b** 68.95±16.14
pH_1 - LD	**a** 6.32±0.31	**b** 6.03±0.25
pH_{24} - LD	5.54±0.14	5.52±0.07
R_1 (IMP/ATP) - LD	**a** 0.94±0.10	**b** 1.02±0.11
Meat lightness - LD	17.05±2.13	17.77±2.40
WHC (cm^2)	5.51±1.28	5.74±1.40
RTN (%) - LD	89.30±3.44	87.67±2.90
PSE meat with pH1 < 5.8 (%)	10	25
pH_{24} - BF	5.75±0.25	5.80±0.17
pH_{24} - SM	5.72±0.26	5.84±0.28
Technolgical yield of curing and smoking ham (%)	104.41±6.43	102.27±8.94

Explanations: LD - Longissimus dorsi; SM - Semimebranosus; BF - Biceps Femoris; RTN - Technological Napole"yield; means with different letters differs significantly at P≤0.05

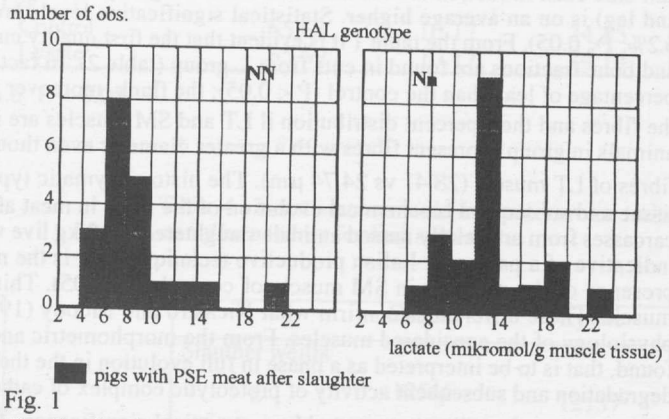

Fig. 1

The distribution of lactate measured in biopsy samples

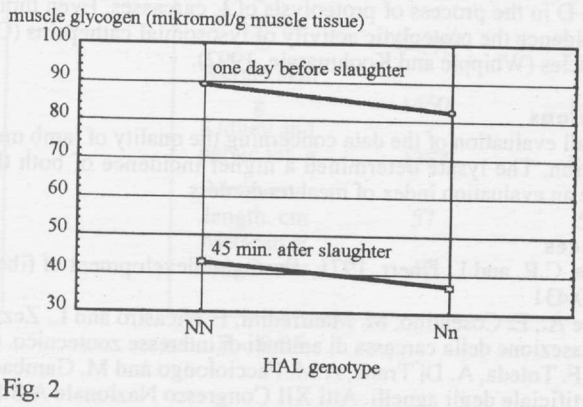

Fig. 2

Muscle glycogen measured in vivo and post mortem and their consumption during slaughter process