CASS AND MEAT QUALITY OF F_2-CROSSES BETWEEN EUROPEAN WILD PIG AND DOMESTIC PIG

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experiment originally designed for pig genome mapping was used in order to study carcass and
cle development as well as meat quality of F_2-crosses between the European Wild Pig and the
estic pig. The pigs (n=192) were typed for the halothane gene by using the genetic polymor-
m in the CRC gene. As a marker for the influence of domestic and 'wild' genes, grouping
ed on the length of the small intestine was used (below or above the mean length). At as-
ment, the carcasses were divided into cuts, the back and ham were defatted, and the M.
laissimus dorsi and the large muscles of the ham were weighed separately.
e effect of the CRC[4] gene (the halothane gene) was very obvious, although no animals had the
e in homozygote form. Carriers of the gene were leaner and had higher reflectance value,
er waterholding capacity, lower pH_u, higher protein denaturation and higher shear force
e. When the grouping was made according to the length of the small intestine, those animals
h a short small intestine were older at slaughter and had a lower growth rate than the other
p. The carcasses were shorter, the head narrower, and the femoris bones were lighter. The
rcasses had less lean meat, more leaf fat and more subcutaneous fat. No difference in meat
ality could be discerned between the groups.

TRODUCTION

ring selection, the domestic pig has become fast growing, meaty and has a high feed efficien-
. Negative effects of the high meatiness are an increased stress susceptibility leading to an
erior meat quality after slaughter. The negative genetic correlation that exists between
t quality and lean meat content is, however, mostly attributable to the halothane gene. It
now established that the halothane reaction is caused by a mutation in the calcium release
nnel gene (CRC; OTSU et al., 1991), leading to a defect in the calcium regulation. The halo-
ne mutation is responsible for the Malignant Hyperthermia Syndrome (FUJII et al., 1991; OTSU
al., 1991). It has not been ascertained whether the same mutation also influences meat con-
t and meat quality, or whether the connection is due to a strong linkage between the CRC
ne and genes affecting the other traits. The effect of selection per se on meat quality has
en shown to be very limited (McPHEE et al., 1991; KARLSSON et al., 1992).

e European Wild Boar has a slower growth rate than that of the domestic pig, and the carcass
gcoats fat at an earlier age (CLAUSEN & GERWIG, 1955; WOOD & NUTE, 1990). Whether the meat
ality of the European Wild Boar is different from our domestic breeds is not fully known.
e purpose of this study was to use an F_2-cross between the European Wild Boar and the domes-
c pig in order to investigate variations in carcass composition and meat quality. Moreover,
e influence of the CRC alleles on the various traits was also studied.

TERIAL AND METHODS

imals and feeding: A Swedish reference pedigree for pig gene mapping has been developed,
ring a cross between the European Wild Pig and the domestic pig. One of the 2 wild boars used
the parental generation was found to be a carrier of the halothane gene, while the 8 domes-
c Swedish Yorkshire sows were non-carriers. The parents of the F_2 generation were 4 sires and
0 dams from the F_1 generation. Altogether, 192 pigs from the F_2 generation were studied. The
ge were sent to slaughter at a live weight of at least 80 kg or a minimum age of 190 days. A
w pigs were slaughtered before reaching these thresholds. Due to fighting, the shortest pos-
ible holding time in the lairage was used. The animals were stunned with low voltage electri-
ty using a restrainer. At slaughter, the total length of the small intestine was measured

according to PETERSSON et al. (1979). Two days after slaughter the chilled carcasses were in ham, back, streak and shoulder. All cuts were weighed separately. The back and ham defatted and further dissected into the following muscles: **M. longissimus dorsi** (LD), **M. femoris** (BF), **M. quadriceps femoris**, **M. semitendinosus**, **M. semimembranosus et adductor**, and **gluteus**. Sidefat thickness was measured at the last rib.

Meat quality: Meat quality measurements were performed on the LD-muscle only, unless other stated. Meat colour was determined as surface reflectance on a cross-section of the LD-mus using an EEL apparatus equipped with a Y-filter (**EEL**; Diffusion Systems Ltd., London, Engl 400-700 nm). Water holding capacity was measured as (1) **drip loss** (HONIKEL, 1987); and subjectively as **filter paper wetness** (KAUFFMAN et al., 1986). The scores used ranged from 5, where 0 denotes a dry filter paper and 5 the other extreme. Extractability of total mus **proteins** (sarcoplasmic and myofibrillar proteins) and of **sarcoplasmic proteins** was determ on minced muscle by a method modified from that described by LUNDSTRÖM et al. (1988). The ret method was used to determine the protein concentrations. **Pigment content** was analysed alkaline hematin according to the method of KARLSSON and LUNDSTRÖM (1991). **Ultimate pH** measurements were performed in LD and BF. **Shear force** in LD was made using the Warner-Brat apparatus. The muscles were frozen 3 days after slaughter, and the muscles were cooked to **DNA typing of genetic polymorphism in the CRC gene:** Two methods were employed for typing tic polymorphism in the calcium release channel gene (**CRC**). Firstly, the point mutation codon 615 controlling the halothane reaction (FUJII et al., 1991) was analysed using an allele specific PCR (ANDERSSON & JOHANSSON, in preparation). Secondly, a three-allele restrict fragment length polymorphism (RFLP) was analysed as previously described (MARIANI et a 1992). By combining the PCR and RFLP typing, four **CRC** alleles could be distinguished. The allele in our nomenclature corresponds to the **HAL** mutation controlling the halothane reactio **Statistical analyses:** A grouping of the material was made according to the length of the small intestine: animals having below vs. above the average length of the small intestine (mea 17.5 m). The 8 **CRC** genotypes were grouped into 3 classes; those carrying the **CRC** allele 1 (d riving from the domestic pigs); those carrying the **CRC** alleles 2 and 3 (deriving from the wi boars, except for 2 individuals); and those carrying the halothane mutation **CRC**^{4}. The stat tical analyses were carried out with the Statistical Analysis System (SAS INSTITUTE Inc 1985), using the GLM procedure. The statistical model used included the effects of batch, within batch, dam, small intestine length class, **CRC** genotype and sex. The weight of the ca cass was used as a covariate when significant.

RESULTS AND DISCUSSION

Production traits, carcass characteristics and meat quality traits for the **CRC** classes presented in Table 1. The effects of the **CRC** alleles were very obvious, regarding both content and meat quality. Even if no animals had the **CRC**^{4} allele in homozygote form, ani carrying that gene had approximately 3 units higher lean meat percent in the ham in compari with non-carriers. The meat quality traits directly linked to protein denaturation (the extr tability of sarcoplasmic and total proteins, and the reflectance value) were especially affe ed. Traits concerned with the waterholding capacity (drip loss and filter paper wetness) w also influenced, but the difference between the **CRC**^{4} class and the other two classes was le The results are in accordance with an earlier study made on all three halothane genotyp (LUNDSTRÖM et al., 1989), and do not seem to be influenced by the special genetic environm in this case. The shear force value was also affected, with animals carrying the **CRC**^{4} allel being less tender. A similar result was obtained by BOLES et al. (1991), who also found a ne tive effect on tenderness of the halothane gene, with differences between all three halothan genotypes. In addition, a tendency to a reduced meat content was found in the **CRC** class 2 w both alleles derived from the wild boars, in comparison with the **CRC** class 1 with the C allele derived from the domestic pig (P=0.08). Moreover, some of the ham muscles were small in **CRC** class 2 than in the other two classes, and the carcass length was shorter. When dissected muscles in the ham were added together, all three **CRC** classes differed significantly

classification based on length of the small intestine was used as a marker for the influence domestic and 'wild' genes, respectively. In animals whose small intestine length was below verage, growth rate was much slower (384 vs 420 g; $P \leq 0.001$), age at slaughter was higher 07) vs 206 days; $P \leq 0.001$), carcasses were shorter with a narrower head, and the bones in the were lighter. No difference was found in carcass weight. For the various measurements of carcass fatness, a large difference could be seen between the groups regarding both amount of ite fat and sidefat thickness. The difference in meatiness was smaller; the proportion of n meat and bone in back and ham was about 1 percent unit less, but e.g. the weight of all sected muscles in the ham was the same in both groups.

e wide variation in production and carcass traits that was seen in the F_2-crosses between d pigs and domestic pigs was as expected. Only a few results have previously been published ere wild pigs could be compared with domestic pigs on an equal basis. WOOD & NUTE (1990) ared 'Iron Age' pigs (formed from European Wild Pig and the Tamworth) and Large White pigs. 'Iron Age' pigs were almost twice the age of the Large White pigs at 65 kg, and were iden- ed as a genotype reaching a certain stage of maturity at a light weight, compared with ge White. In Denmark, wild pigs were crossed with Danish Landrace in various proportions, m 75% wild pig to 3.1%, and the pigs were tested in the pig progeny testing scheme (CLAUSEN ERWIG, 1955). In comparison with pure Landrace, growth rate between 20 and 90 kg in the 75% es was 42%, age at 90 kg was 215%, carcass length was 90%, the backfat was 113% and the gth of the small intestine was 65%. In the Danish F_2-cross, the length of the small intes- e was very close to the average length found in this study (17.55 m). In our study, where we ed to find a marker trait for the influence of 'wild' genes, the length of the small intes- e seems to be quite appropriate. The length of the small intestine can probably be regarded an indicator of the mature weight of the pig. Even at 25 kg live weight, the small intestine the domestic pig has reached approximately 80% of its length at 100 kg (PETERSSON, 1990).

Table 1. Production, carcass and meat quality traits in the CRC classes

Trait	CRC class 1	CRC class 2	CRC class 3	Level of significance for the CRC class
ge at slaughter, days	213	209	212	n.s.
arcass weight, kg	60.3	62.8	60.5	n.s.
arcass length, cm	90.7[a]	89.2[b]	90.1[a]	**
ean meat and bone in back ed ham, %[1]	73.1[a]	72.0[a]	75.5[b]	***
t of ham muscles, kg	3.45[a]	3.34[b]	3.59[c]	***
idefat, mm	20.9[a]	22.3[a]	18.5[b]	**
flectance value, EEL	17.3[a]	18.0[a]	21.7[b]	***
ip loss, %	4.7[a]	5.1[b]	5.6[b]	*
lter paper wetness	1.8[a]	2.0[b]	2.4[b]	*
oteln extractability, mg/g et weight				
total				
Sarcoplasmic	155.0[a]	160.3[a]	103.1[b]	***
LD	71.0[a]	75.6[a]	58.6[b]	**
BF	5.67[a]	5.64[a]	5.53[b]	*
ear force, kg/cm²	5.95	5.86	5.89	n.s.
	4.8[a]	4.1[b]	5.5[c]	**

[1] Percentage of total back and ham.
Level of significance: n.s. = $P > 0.05$; * = $P \leq 0.05$; ** = $P \leq 0.01$; *** = $P \leq 0.001$.

Meat quality traits were not affected by intestine classification in our study. Differe
between domestic pigs, wild pigs and crosses between them have been reported regarding ten
ness. TOWNSEND et al. (1978) found that loins from wild pigs had both higher shear force va
and less tender meat, in comparison with Yorkshire pigs or crossbred Yorkshire x wild pi
After curing of the hams (TOWNSEND et al., 1979), no differences in sensoric properties w
found between groups. The 'Iron Age' pigs mentioned above (WOOD & NUTE, 1990) were also te
tested, but they did not differ as regards eating quality, compared with Large White pigs.

CONCLUSION

The effect of the halothane gene was very obvious, although no animals had the gene in hom
gote form. Classifying the animals according to the length of the small intestine, seems
give a marker for the influence of 'wild' and domestic genes.

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