New Meat Quality Characteristics

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Introduction

The main selection goal in pig production over the last 30 years in most European countries aimed to increase meat percentage, daily gain, meat efficiency and reproductive performances. Maximising these traits means maximising the profit of pig production. Meat quality characteristics have always been in the discussion, but within all different payment systems for carcasses no meat quality traits were included so far. The discussion about meat quality mainly included the technological meat quality in terms of the occurrence of PSE (pale, soft and exudative) and DFD (dark, firm and dry). To describe PSE and DFD measurements like pH, conductivity and colour are possible objective measurements. Although there is no direct economic weight for these meat quality criteria they are included in the breeding objective of most of the modern breeding companies in Europe. The breeding companies have recognised that in the long term they can not afford a decrease in these quality traits to maintain the level of pig meat consumption. With the detection of the relationship between halothane reaction or nowadays the MHS-gene-test and meat quality breeders have got a good tool to keep meat quality at an adequate level. In the last 5 years meat quality in terms of sensoric meat quality became more and more important. Some aspects of sensoric meat quality and its relationship to intramuscular fat and the technological meat quality traits are given in this paper.

What is meat quality?

Discussions about meat quality show that between producers, meat industry and consumers there are often differences in defining mat quality. One good and more general definition of meat quality could be as follows:

The sum of all sensoric, physiological, hygienic and technological characteristics of meat.

The technological characteristics mainly include pH- Value, drip loss, fat content as well as number and thickness of muscle fibres. The major sensoric characteristics include tenderness, juiciness, taste, smell, as well as colour and marbling. For physiological, hygienic and technological characteristics of meat objective measurements are available. Some technological characteristics could be measured within the normal slaughter procedure at adequate costs. Danish and German abattoirs use these measurements to select PSE- and DFD-free meat for the export or for so called meat quality programs. Sensoric characteristics can only be assessed by trained taste panels through subjective scoring. The amount of intramuscular fat has often been seen as an objective measurement that is correlated to sensoric characteristics of pig meat. In the following table 1 some correlations between intramuscular fat and tenderness, juiciness and taste are shown

Table 1. Phenotypic correlations between intramuscular fat and sensoric characteristics of pigmeat

Source	Correlation between intramuscular fat and sensoric trait		
	tenderness	juiciness	taste
Davis et al (1975)	.41	.42	.12
Devol et al (1988)	.32	.21	.23
Greshake(1988)	.22	.24	.25
Meyer(1991)	23	.21	.15

Table 1 shows a low to medium positive phenotypic correlation between intramuscular fat and all sensoric traits. Danish investigations (Barton-Gade and Bejerholm, 1986) showed that there is no linear relationship between intramuscular fat and the sensoric traits. The Danish experiments concluded that differences in sensoric traits could only be picked up above 2% intramuscular fat. For an amount of intramuscular fat above 4 to 5% there was no further increase in sensoric traits observed.

Sensoric characteristics of pigmeat and correlations to other carcass traits

In table 2 the results of a comparison between 6 different final products for sensoric characteristics and intramuscular fat are shown. Within each breed about 200 animals (sows and castrates) have been fat on one farm under the same feeding regime. A sample of 50 animals each breed have gone through the sensoric taste panel. A scoring system from 1 to 6 was used by 6 people at the same time.

Table 2. Least square means of sensoric characteristics and intramuscular fat of final products of 6 German breeds (Meyer, 1991)

Breed	intramuscular fat	tenderness	juiciness	taste
Pi*LR	1.79	3.28	3.31	3.40
(HA*Pi)*(LW*LR)	1.99	3.47	3.37	3.39
BHZP	1.86	3.71	3.74	3.71
PIC	1.89	3.38	3.42	3.46
New Dalland	2.56	3.88	3.93	3.71

Pi = Pietrain LR = Landrace LW = Large White HA = Hampshire

Table 2 shows very small differences between all breeds only the pigs from New Dalland show a much higher amount of intramuscular fat and are the top animals in tenderness and in juiciness. The difference in taste to the other breeds is smaller and not significant. The percentages of animals that show in all sensoric characteristics a score of 4 and higher are 21% for BHZP and New Dalland, 17% for Pi*LR, 13% for Pi*(LW*LR) and only 8% for the other 2 breeds.

In table 3 phenotypic correlations between the sensoric characteristics and other carcass traits are shown.

Table 3. Phenotypic correlations between sensoric characteristics and carcass traits (Meyer, 1991)

	tenderness	juiciness	taste
meat percentage	-.17	-.16	-.17
backfat	.11	ns	.13
pH-Value 45 min	.25	.23	.17
conductivity 24 h	-.38	-.34	-.31

The results of table 3 show a low but negative correlation between meat percentage and all sensoric traits. The pH-Value measured 45 minutes after slaughter and the conductivity 24 hours after slaughter show a positive correlation from a breeding point of view to all sensoric traits. Estimates of genetic correlations could give an answer about correlated genetic responses in sensoric traits when selecting for technological quality traits. There

are no estimates of genetic correlations between sensoric traits and other carcass traits available so far.

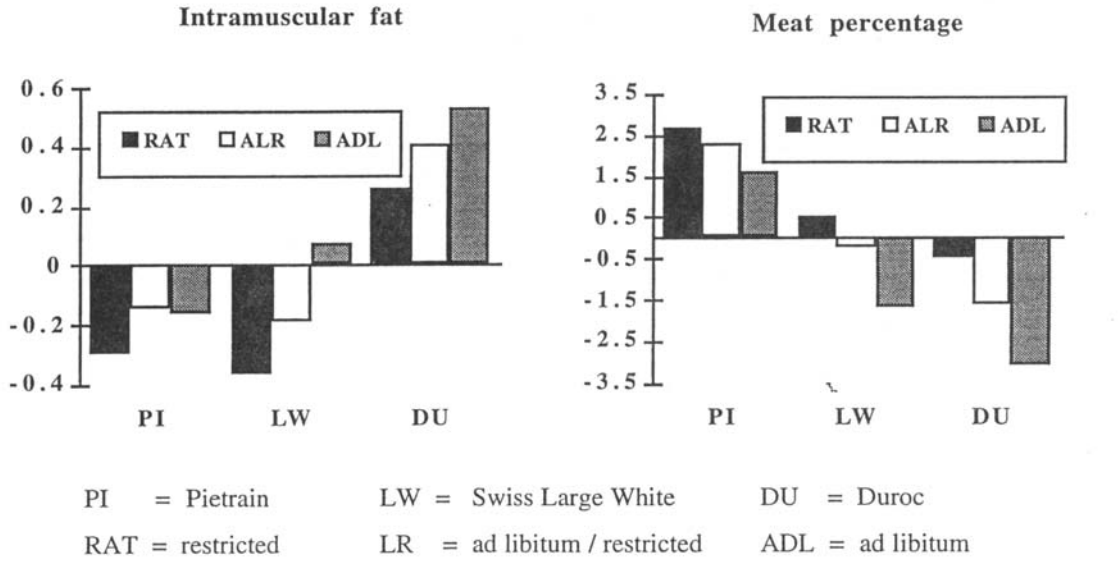
Effects of feeding regime on meat quality traits

Besides the genetic improvement of meat quality traits is seems to be interesting to see how the feeding regime (ad libitum or restricted) would have an influence on meat quality criteria. In Switzerland an experiment was carried out under test station conditions to compare three genotypes of pigs from 25 kg to 103 kg live weight under three different feeding regimes (Affentranger, 1994). Crossbred animals from Swiss Landrace dams mated to Pietrain, to Swiss Large White and to Duroc boars were compared under ad libitum feeding, restricted feeding during the entire fattening period and ad libitum feeding up to 65 kg and then restricted until the end of fattening period.

The results clearly show that there are large differences in all meat quality traits between breeds but no differences between feeding regimes. The Duroc crossbreds show in all traits the best meat quality while the Pietrain crosses range at the bottom in meat quality. There is a significant influence of the feeding regime on intramuscular fat within all genotypes. In the following diagrams the differences in intramuscular fat and meat content between breeds and between feeding regimes are shown.

The diagram shows that a restricted feeding regime over the entire fattening period will result in the lowest amount of intramuscular fat in all three breeds but with the highest amount of meat percentage. On the other hand an ad libitum feeding system throughout the entire fattening period will increase the amount of intramuscular fat. The result would be also a better sensoric meat quality but with the penalty for lower meat percentage. The diagrams also show that for both traits the breed differences are much higher than the differences between feeding regimes.

Intramuscular fat and meat percentage as deviation from mean for different breeds and feeding regimes (Affentranger, 1994)



PI = Pietrain LW = Swiss Large White DU = Duroc

RAT = restricted LR = ad libitum / restricted ADL = ad libitum

Conclusion

Sensoric meat quality characteristics are difficult to assess although there is a low to medium positive phenotypic correlation to the amount of intramuscular fat. The sensoric meat quality traits show from a breeders point of view also a positive phenotypic correlation to technological quality traits like pH-Value or conductivity. There seems to be an antagonistic relationship between meat percentage and sensoric meat quality traits. Genetic correlations between sensoric traits and other carcass traits have still to be estimated.

There is a possibility to increase sensoric meat quality traits through the feeding system by increasing the intramuscular fat content but with an simultaneous decrease in meat percentage. Differences in intramuscular fat between breeds are much higher than differences between feeding regimes.

As long as there is no economic value for neither sensoric nor technological meat quality traits any increase in meat quality would result in an economic loss through a decrease in meat percentage, the major component of income in pig production.

In a long term view the meat quality in total have to be maintained on an adequate level to maintain or even increase the pig meat consumption.