COMPARISON OF 3 PIG BREEDS IN TERMS OF MEAT QUALITY AND EVALUATION OF CUT OFF CRITERIA FOR ESTABLISHING A QUALITY PROGRAM

D. Mörlein*, G. Link and M. Wicke

Research Centre for Animal Production and Technology, University of Göttingen, Driverstrasse 22, D-49377 Vechta, Germany. Email: daniel.moerlein@agr.uni-goettingen.de

Keywords: pork, drip loss, PSE, IMF, electrical conductivity, *longissimus dorsi*

Introduction

Until today the meat industry is facing the variability of meat quality regardless of numerous concerns for its improvement, e.g. breeding programs, feeding regimes, slaughter handling etc. Despite those efforts, post slaughter there is still variation in meat quality. Currently, polarisation between discount and premium segments has been observed. Thus, in order to satisfy the premium consumer's need for constant & guaranteed quality it is necessary to select carcasses with quality beyond the standard. This research focuses on evaluating the status quo of carcass traits, meat composition and sensory properties of pigs currently found at the market in Germany. Simulating a meat quality program, we also aimed to evaluate property thresholds that may guarantee better eating quality bearing in mind the percentage of pigs meeting this program's conditions.

Materials and Methods

This research included in total 606 pigs originating from 3 commercially available breeds (both castrated male & female). The pigs were slaughtered in a commercial abattoir within regular conditions (electric stunning) at 6 dates distributed within one year. Thus, we realised a nearly fully balanced design (6 dates * 3 breeds * 2 sexes). The carcasses for the research were randomly selected except for design conditions. Slaughter weight and carcass traits were provided by the company using SFK Fat-O-Meater. Electrical conductivity (EC) at *longissimus* muscle was measured at 2nd/3rd last rib 24 hours post mortem with Matthäus LF-star. Drip loss of samples taken 24 hours post mortem was measured according to the bag-method (Honikel, 1987) after 48 hours storage time at 4°C. From an adjacent cutlet intramuscular fat was extracted (petrol ether) with prior HCl pre-treatment. Another sample was cooked on a contact grill to 73°C core temperature to further measure cooking loss and shear force. Sensory properties of 328 samples were determined by a 6 member instructed panel. Statistical analyses were performed with SAS PROC MIXED including fixed effects (breed, sex, date of slaughter) and all interactions.

Results and Discussion

In Table 1 least squares means of selected parameters are presented with relation to breed and sex, respectively.

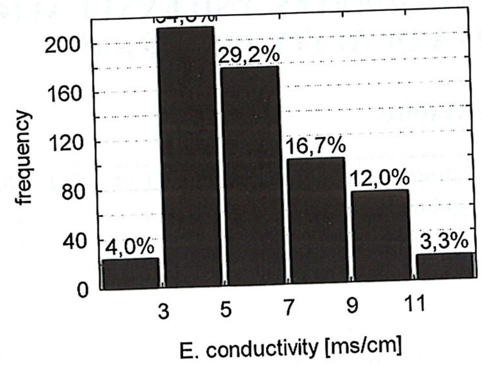
Table 1: LS means of selected traits dependent on breed and sex, respectively (n = 606).

trait	breed Breed G	 Breed H	 Breed S	sex castrates	 females
Slaughter weight [kg]	95.18 [b]	93.51 [a]	95.61 [b]	94.67	94.87
Meat percentage [%]	58.20 [b]	57.32 [a]	57.41 [a]	56.87 [a]	58.43 [b]
Backfat thickness [mm]	15.18	14.99	14.81	15.83 [b]	14.15 [a]
Muscle thickness [mm]	65.56 [b]	62.58 [a]	63.42 [a]	63.55	64.16
LD muscle area [cm²]	54.80 [c]	51.15 [a]	52.34 [b]	51.35 [a]	54.17 [b]
Intramuscular fat [%]	1.03 [a]	1.20 [b]	1.39 [c]	1.32 [a]	1.10 [b]
E. conductivity [mS/cm]	6.30 [b]	5.86 [a]	6.45 [b]	6.08	6.33
Drip loss [%]	6.38 [b]	6.70 [b]	5.92 [a]	6.43	6.24
Cooking loss [%]	29.79 [ab]	30.15 [b]	29.25 [a]	29.91	29.55
Shear force [N]	47.84 [b]	44.35 [a]	45.52 [a]	45.98	45.83

[a,b,c] different superscripts indicate significant differences between breeds and sexes, respectively ($\alpha < 0.05$)

The IMF content of most of the samples did not reach the level of 1.5 – 2.0 percent as is usually recommended with respect to optimal eating quality. Clearly, breed differences exist with breed S outperforming the other breeds under investigation. This was most probably due to the 25% Duroc in that breed. Besides, that breed shows significantly less drip loss. Interestingly, genotype S showed the highest mean EC values despite the lowest drip loss. Contrarily, breed G performs best in terms of meat percentage and muscle area. At the same time IMF was lowest compared to the other breeds.

In Figure 1 relative frequency distribution of Electric conductivity (EC) values (left) and mean drip loss (48 hrs.) dependent on EC values (right) are depicted for all samples regardless the breed.



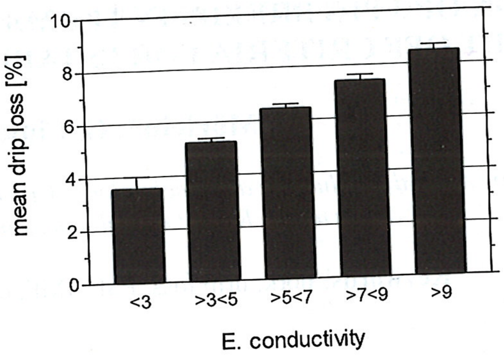


Figure1: Relative frequencies of Electric conductivity (EC) values (left) and mean drip loss dependent on conductivity class (right; LS means ± standard error of mean); n = 606.

Applying EC values above 7 and 9 ms/cm as indicators for pale, soft, exudative (= PSE) conditions of the meat, we must state that 32.0 and 15.3 percent, respectively of the samples under investigation were PSE like. From a recent monitoring in 6 commercial slaughter facilities in German that covered more than 20,000 carcasses (Altmann *et al.*, 2005), the authors applied the more strict EC values greater than 7 ms/cm. Thus, they similarly concluded up to 27% of the carcasses show PSE - in accordance with Warriss *et al.* (1998) for carcasses in the EU. The relationship between drip loss and EC can also be seen from Figure 1 (right). Above breeds, the mean drip loss significantly increased between EC classes.

Table 2 shows the results, *i.e.* yield of carcasses in % and corresponding traits, after application of 2 cut off criteria (meat percentage and conductivity) in order to select carcasses with favoured traits, especially less drip and more IMF. Among all breeds, a slight increase in IMF and remarkable decrease of drip was noted as well as an enormous decrease of the yield: more than 50% were cut off. This is partly due to breed S because of the higher EC values. Only 37 % of breed S carcasses meet the criteria. However, with respect to the favoured traits this breed performs best showing least drip and mean IMF around 1.50%. Nevertheless a big variation both of drip loss and instrumental tenderness remained (data not shown).

Table 2: Application of EC and lean meat percentage cut off values to discriminate carcasses.

trait	original data, no cut off	Quality program criteria: lean meat > 54 < 59 %, EC < 7 ms/cm All carcasses	Breed G	Breed H	Breed S
program carcasses [%]	100	43.6	41.1^{+}	51.0^{+}	37.1^{+}
Slaughter weight [kg]	94.91	94.12	95.2^{b}	92.7^{a}	94.9^{b}
Meat percentage [%]	57.6	56.82	57.0^{b}	56.8^{ab}	56.5^{a}
E. conductivity [mS/cm]	6.24	4.82	5.04^{b}	4.87^{b}	4.48^{a}
IMF [%]	1.21	1.24	1.05^{a}	1.22^{b}	1.50^{c}
Drip loss [%]	6.37	5.49	5.47	5.68	5.19
Shear force [N]	45.92	44.75	46.4	44.2	43.8
Liking score*	52.15	53.03	51.3^{a}	51.6^{a}	56.3^{b}

$^{+}$ relative proportion within breed.
* sensory liking score: 0 = worst … 100 = best.
^{a,b,c} different superscripts indicate significant differences between breeds (α< 0.05).

Conclusion
The strategy of choice for implementation of a meat quality program shall include both the selection of a certain breed and discrimination of "premium carcasses" at slaughter. The data presented here suggest the application of EC measurement since it is more reliable and less dangerous (no glass electrodes that can break) compared with pH measurements. The threshold carcasses with lower drip loss and higher IMF content were selected.

References

Altmann, M. *et al.* (2005). Incidence of PSE condition in market hogs - Monitoring results for various abattoirs in Germany. Fleischwirtschaft, 85: 101-104.
Honikel, K. O. (1987). The water binding of meat. Fleischwirtschaft, 67: 1098-1102.
Warriss, P. D. *et al.* (1998). An analysis of data relating to pig carcass quality and indices of stress collected in the European Union. Meat Science, 49: 137-144.