

Implications of genotype and amino acid supply on pork quality

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Abstract - An experiment was conducted to evaluate the effect of different feeding regimes and genotypes on growth performance, carcass characteristics, composition and eating quality of pork under organic framework conditions. 198 individually housed pigs of 4 genotypes were allocated to three dietary treatments. Feeding regimes differed in relation to the supply of limiting amino acids (AA). The genotypes used were Pi x (DL x DE); Du x DL, Pi x German Swabian Hall (Pi x SH) and pure SH breed.

While Pi x (DL x DE) pigs showed the highest carcass yields, pigs of the genotype Du x DL achieved higher values in dlwg and in meat composition compared to the other genotypes.

Performance traits were significantly influenced by the feeding regime. Lean meat percentage and area of M.I.d. were significantly lower when a diet reduced in limited amino acids compared to the control treatment was fed. Backfat thickness was not influenced by the feeding regime. However, intramuscular fat content clearly increased when a diet without AA supplementation was fed.

The results indicate that the limited availability of high quality feedstuffs in organic farming does not impair but improve the preconditions to produce pork of high eating quality.¹

INTRODUCTION

A feeding trial was carried out to test the hypothesis that pigs with different genetic potential for protein accretion react differently to an unbalanced supply with amino acids in the grower and the subsequent finisher phase, and thereby provide different eating quality of pork. A reduced supply with limited amino acids in the experimental treatments represented the limited availability of these nutrients in organic pig production.

METHODS

A total number of 12 treatments (3 feeding regimes x 4 genotypes) were tested. Three different diets were used: - **CON** = control diet, closely related to the recommendations according to GfE (1987),

- **FIN** = diet, balanced in the growing phase, and unbalanced in AA in the finishing phase,

- **GRO + FIN** = diet, unbalanced in AA in both the growing and the finishing phase.

Four different genotypes were used: Pietrain x (German Landrace x Large White) (Pi x (DL x DE)), Duroc crossed with a strain of German Landrace (Du

x DL), Pietrain x German Swabian Hall (Pi x SH), and purebred German Swabian Hall breed (SH). The first two breeds had 22 animals per feeding regime (11 male and 11 female). The other genotypes included only males (11 each group). The feedstuffs were organically produced and formulated to three feeding regimes: the first (I) according to the recommendations of the German Society of Nutritional Physiology (GfE, 1987); the second (II) with an reduced supply of essential amino acids in the finisher phase and the third (III) with a reduced supply of essential amino acids in both the grower and the finisher phase. The animals were housed individually in pens and slaughtered at a live-weight of 120 kg. The following criteria were assessed:

Performance criteria: composition of the diets, feed intake, daily gain, feed conversion ratio, carcass characteristics: lean cut yield, subcutaneous fat, *M. longissimus* (area, colour, score, firmness score).

Quality criteria: pH₁, pH₂₄, conductivity, reflection, IMF content (% in *M.I.d.*), fatty acids, shear force, drip loss (%).

Histological criteria: total number of muscle fibre.

Eating quality: tenderness, juiciness, flavour, overall liking.

RESULTS

Because of the restricted availability of limited amino acids performance and lean meat percentage of the carcasses was clearly reduced. Compensatory growth effects were obvious only for the Du x DL genotype and not detected in the other genotypes. Due to a comparable high feed intake and compensatory growth effects, the Du x DL genotype proved to be most suited in relation to the restricted availability of high quality feedstuffs. Pigs of the genotype Pi x (DL x DE) obtained a higher lean meat percentage and a higher meat area of M.I.d. compared to the pigs of Du x DL. In contrast, Du x DL pigs showed higher pH₁-values and a higher IMF content in M.I.d. than the pigs of the Pi x (DL x DE) genotype. Results of the SH breed were the worst in performance as well as in meat quality traits compared to the other genotypes. While female pigs produced a higher carcass yield and a higher lean meat percentage, castrated pigs achieved a higher growth rate and a higher IMF content in the M.I.d. The results emphasized the existence of an antagonistic relationship between quantitative and qualitative traits. Pigs with different genetic capacity for protein accretion reacted differently to an unbal-

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anced supply of amino acids and thereby provided different carcass yields and meat composition. Thus, the working hypothesis was confirmed. In contrast, the concern that unbalanced diets consequently result in an increase of backfat thickness was not confirmed. In order to obtain a high IMF-content in the M.I.d., the feeding regime clearly is of higher importance than the genotype. Genotype feeding interactions have not been detected. Production costs of the feeding regime GRO+FIN are clearly higher and the payment according to carcass grading is clearly lower compared to the conventional feeding strategy (CON).

The feeding regime had a clear influence on the fatty acid composition of IMF in the M.I.d.. In general, poly unsaturated fatty acids (PUFA) decreased while mono unsaturated (MUFA) and saturated fatty acids (SAFA) increased in feeding regime GRO+FIN compared to the CON regime. IMF content in M.I.d. was negatively correlated to the PUFA content.

Concerning the eating quality of pork, consumers in the hedonic test panel considered all products neither juicy nor tender enough. Pork derived from the feeding regime GRO+FIN, providing the highest IMF content, achieved the highest values of overall liking, juiciness and tenderness, but not in relation to flavour.

Correlation coefficients between IMF-content and overall liking of pork varied to a high degree ($r = 0.80$ and $r = -0.80$) between consumers, indicating that the consumers reacted very differently to the IMF content in pork. With more than 70%, the majority showed a positive correlation coefficient between IMF content and overall liking. The correlations between IMF and the juiciness, tenderness and flavour showed similar results. Taking into account the differences in the preference of the test persons, multiple linear analysis was conducted. The regressions showed a low coefficient of determination (R^2), but a high level of significance ($p < 0.01$). The preferences for pork was affected, in the first place, by the IMF-content. Other factors such as the LF_{24} played a minor role. On the other hand, dislike of pork seemed to be determined exclusively by the IMF content.

CONCLUSIONS

The exclusion of AA supplementation resulted in a reduction in pig performance but in an increase of the intramuscular fat content (IMF). The results indicate that it is possible to raise the IMF content by the use of specific feeding regimes, thereby playing a major role in relation to eating quality features. Thus, the framework conditions of organic farming do not deteriorate the preconditions for a high quality production of pork. Furthermore, the results indicate that the feeding strategy has to be closely adapted to the genotype used and to the availability of limited resources for both pork quality and economical reasons. Because of the restricted availability of limited amino acids and the high production costs, quality production of organic pork is a *conditio sine qua none* to develop an organic premium line.

IMPLICATIONS

Currently, the economical implications put pressure on the farmers to produce carcasses with a high lean

meat percentage because of the higher growth rates, shorter fattening period, better feed conversion and last but not least higher carcass yield and carcass payment according to the current carcass grading system E-U-R-O-P. The current payment system prevents the organic farmer from producing pork with a high eating quality because it is primarily focused on the production of lean meat and does not honor the production of pork with a high eating quality.

The results indicate that consumers react very different on pork with a high IMF-content. Diversity of customers requires diversity of markets. To arise attraction to pork of high IMF-content there is need to inform consumers by labelling so that they can integrate this information into the decision for purchasing and in their willingness to pay premium prices for a premium product. If the demand for a high quality production within organic farming should get a chance, there is need for a change in the payment system, in the way of labelling and in the framework conditions of the market.

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