Carcass and meat quality of different pig genotypes in an organic extensive outdoor fattening system

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Abstract – Carcass, meat, and fat quality were evaluated of 37 castrates of 4 different genotypes [Pi*Du*GLR (10), Pi*AS (7), Du (10), Du*GLR (10)] kept on grass clover and fed with coarse meal made up of farm grown cereal and grain legumes without optimising the amount of amino acids and their relation to the energy content. Due to the energy surplus in the diet and in relation to the diminishing muscularity of the genotypes (corresponding to the above-mentioned sequence) lean meat contents were on a low level whereas intramuscular fat contents increased distinctly. Sensory meat quality was only at a medium level and did not differ noticeably between the genotypes. It is concluded that adipose carcasses associated with increased intramuscular fat contents do not lead automatically to higher sensory meat qualities. Therefore the system boundaries of organic pig fattening cannot be used without further efforts supplying market niches for pork of high eating quality.[1]

Introduction

It can be expected that the system immanent conditions of organic pig fattening lead to more adipose carcasses compared with conventional intensive systems, first of all due to the lack of essential amino acids (Weissmann et al., 2005b). However, higher body fat synthesis tends to result in higher intramuscular fat content with positive effects on the criteria of sensory meat quality such as tenderness, juiciness and flavour (Fischer, 2001). This could be a chance for organic pork production: To occupy a market niche for high quality pork, as a counterbalance to the adipose carcasses that cannot be sold profitably in marketing systems relying almost exclusively on quantitative carcass characteristics such as lean meat content (Rahmann et al., 2003).

Considering the background mentioned above and the discussion in Germany about the obligation to use exclusively (on-farm) diets of 100 % organic origin, the objective of the present paper is the evaluation of different genotypes with varying protein synthesis capacity concerning lean meat content, intramuscular fat content, sensory meat quality and fatty acid pattern under extensive fattening conditions generating adipose carcasses. For more results concerning performance, carcass and meat quality see Weissmann et al. (2005a).

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Materials and methods

The trial was performed in 2003 at the experimental organic farm of the Institute of Organic Farming of the Federal Agricultural Research Centre in Trenthorst, Germany, in accordance with the Regulation 2092/91/EEC and IFOAM Basic Guidelines.

A single group of 60 fattening pigs of different genotypes and sex (Table 1) were kept outdoors on 5.2 ha grass clover from May to October and indoors (loose house with deep litter) until November. Slaughtering started in September.

Table 1. Allocation of genotypes and sex (n)

Genotype	Castrates	Females
Piétrain * (Duroc * German Landrace) [Pi*Du*GLR]	10	10
Piétrain * Angler Saddleback [Pi*AS]	7	3
Duroc [Du]	10	-
Duroc * German Landrace [Du*GLR]	10	-
Piétrain * (German Large White * German Landrace) [Pi*GLW*GLR]	3	7

Due to the limited capacity for sensory evaluation and the inhomogeneous allocation of sex, only samples of the castrates were tested by the sensory panel. For this reason and due to the unsatisfactory number of castrates of the genotype Pi*GLW*GLR, the present paper deals only with the results of the castrates of the 4 genotypes Pi*Du*GLR, Pi*AS, Du, and Du*GLR.

The fed coarse meal consisted of 70 % winter wheat, 15 % field peas and 15 % field beans with 15.7 MJ ME, 149 g CP, 8.1 g Lysine, and 1.9 g Methionine per kg dry matter. The daily amount of feed was calculated for an intended daily weight gain of 600 g. For detailed information see Weissmann et al. (2005a).

Slaughtering after CO_2 stunning occurred in a commercial abattoir 20 min away from the farm. Determination of PSE-status (pH_{45}, $13^{th}/14^{th}$ rib) and carcass classification by FOM was performed about 45 min after slaughter corresponding to commercial procedures. At 24 h p.m. the samples needed for determination of intramuscular fat content (IMF),

sensory quality and fatty acid pattern were cut out. IMF (M. long. dorsi - 13th rib) was estimated by Near-Infra-Red spectroscopy. Reference values were determined without previous HCl treatment. Fatty acid pattern (backfat 13th rib, outer layer) was analyzed by gas chromatography (Galian et al., 2005) and sensory evaluation (loin chops, 14th-16th rib) was carried out using a six-point scale (1=worst, 6=best) for tenderness, juiciness, and flavour (Fischer et al., 2000).

SPSS 12.0 for Windows was used for statistical analysis according to the model described by Weissmann et al. (2005a).

For more detailed information about animals, keeping, feeding, experimental design, analysis, and statistical procedures see Weissmann et al. (2005a).

Results and discussion

The animals started with an initial live weight of 36.4 ± 5.2 kg and were slaughtered at 113.3 ± 3.1 kg live weight (plus 2.3 % live weight loss) leading to 530 ± 61 g daily live weight gain, 85.8 ± 3.6 kg carcass weight, and 75.7 ± 1.9 % dressing rate.

Three animals were lost: Two due to severe joint problems associated with swine erysipelas, and one animal due to an accident with a tractor. Thus a total of 34 animals remained for analysis on the criteria of carcass, meat, and fat quality (Table 2).

Table 2. LSQ-values for carcass, meat and fat quality of castrates of 4 different genotypes

Genotype	Pi*Du*GLR	Pi*AS	Du	Du*GLR
n	10	7	9	8
Lean meat content (%)	50.6[a]	48.6[a]	48.2[a]	47.5[a]
pH_{45}	6.4[a]	6.5[a]	6.4[a]	6.3[a]
Intramuscular fat content (%)	1.36[b]	1.58[b]	3.49[a]	3.57[a]
Juiciness[1, 2]	3.1[bc]	3.6[a]	2.9[c]	3.4[ab]
Tenderness[1, 2]	2.9[ab]	3.4[a]	2.5[b]	2.9[ab]
Flavour[1, 2]	3.2[b]	3.4[ab]	3.7[a]	3.8[a]
Flavour[3, 2]	4.6[a]	4.8[a]	4.6[a]	4.5[a]
Selected Fatty acids				
- SFA[4] (%)	40.54[a]	39.29[a]	40.66[a]	40.10[a]
- MUFA[5] (%)	46.62[ab]	48.19[a]	47.42[ab]	46.04[b]
- PUFA[6] (%)	7.95[a]	7.89[a]	8.50[a]	7.52[a]

[abc] Different letters indicate significant differences ($p \leq 0.05$)

[1] M.l.d. of the 14th till 16th rib without adjacent fat layer

[2] Six-point scale (1=worst, 6=best)

[3] M.l.d. of the 14th till 16th rib with adjacent fat layer

[4] Saturated fatty acids: C12:0, C14:0, C16:0, C18:0

[5] Mono unsaturated fatty acids: C16:1(ω7), C18:1(ω9)

[6] Poly unsaturated fatty acids: C18:2(ω6), C18:3(ω3), C20:4(ω6)

Carcass quality

Lean meat content of all genotypes was low due to the energy surplus in relation to Lysine and Methionine supply and due to the low protein synthesis rate of castrates. Even the benefit of Piétrain as sire affecting the protein synthesis capacity (Biedermann et al., 2000) was lost, as seen in not significantly increased lean meat contents of Pi*Du*GLR. In the same trial the females actually achieved a remarkable level of 54.3 ± 1.7 % lean meat despite not optimised feeding (Weissmann et al., 2005a).

Meat quality

There were no PSE problems on the basis of pH_{45}.

The intramuscular fat content of the different genotypes increased significantly corresponding to the decreasing lean meat content of the carcasses. Mainly the genotypes Du and Du*GLR reached extremely high values due to the well known positive effect of Duroc as mating partner (Fischer et al., 2000).

Sensory meat quality was only of medium ranking. The significant differences between the genotypes should not be overestimated. Surprisingly it was only in the case of flavour of pure muscle tissue that there was a small tendency corresponding to the ranking of the intramuscular fat contents. The well-reported finding that intramuscular fat contents higher than 2.5 % lead to pronounced sensory qualities (Bejerholm und Barton-Gade, 1986) could not be generally confirmed. The authors have no explanation for this fact. Only the flavour of the lean meat with adjacent back fat was above-average, presumably due to the fatty acid pattern in each group.

Fat quality

Fatty acid pattern is characterized by the predominance of saturated (SFA) and mono unsaturated (MUFA) fatty acids and a small proportion of poly unsaturated fatty acids (PUFA), indicating a firm fat consistency with high oxidative stability, leading to a high technological fat quality. High proportions of SFA and MUFA result from the high rate of de-novo fat synthesis which is responsible for the adipose carcasses of the four genotypes, and from the low PUFA concentration in the diet (Fischer, 2001).

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